Repair Manual
Jetta/Beetle/Passat 2013 ➤

Generic Scan Tool									
Engine ID	CPLA	CPK A							

Edition 07.2021

Service

List of Workshop Manual Repair Groups

Repair Group

ST - Generic Scan Tool

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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Contents

ST – Generic Scan Tool

1 General Information

(Edition 07.2021)

Included in the contents of this Generic Scan Tool (GST) manual is a summary table of the vehicle specific OBD II Emission Related DTCs. The DTC table contains DTC Malfunction Criteria, Threshold Values, Secondary Parameters, Enabling Conditions, Monitoring Time Length, Frequency of Checks, and MIL Illumination information which can be used to accurately monitor and diagnose emissions related faults and perform functions required to run Modes 01 through 0A (if applicable) with a hand held scan tool.

This manual also contains the step by step procedures to accurately diagnose and repair a component or system once a DTC has been set. References to repair procedures and wiring diagrams can be found within the diagnostic test procedures.

♦ ⇒ P1.1 recautions", page 2

♦ ⇒ W1.2 orking Conditions", page 4

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1.1 Safety Precautions

Check for Technical Bulletins that may supersede any information included in this manual.

WARNING

Failure to follow these instructions may result in personal injury or possible death.

Check the Technical Bulletins for information, cautions and warnings that may supersede or supplement any information included in this manual.

When performing the drive cycle operation, pay strict attention to driving conditions and observe and obey all posted speed limits.

Test equipment must always be secured to the rear seat and operated by a second person. If test and measuring equipment is operated from the passenger seat, the person seated could be injured in the event of an accident involving deployment of the passenger-side airbag.

The fuel system is under pressure! Before opening the fuel system, place rags around the connection area. Then release pressure by carefully loosening the connection.

The engine section of the fuel system, after the high pressure pump, is under extremely high pressure! When working on engine or fuel injection system, fuel pressure must be relieved to residual pressure before opening high pressure components. Refer to the Service Manual for the proper procedure.

If the battery has not been disconnected, the fuel pump fuse must be removed before opening the fuel supply system as the fuel pump may be activated by the driver's door contact switch.

Testing of the EVAP and ORVR systems can result in the escape of explosive fuel vapor. Do not smoke while testing the EVAP system, and make sure the area you are working in is well ventilated.

Observe the following for all procedures, especially in the engine compartment due to lack of room:

- ♦ *Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- ♦ *Watch for sufficient clearance to all moving or hot components.*
- ♦ *Do not touch or disconnect the Ignition Coils, ignition wires, connecting parts or adapter cables when the ignition is on or the engine is running or turning at starting RPM.*
- ♦ *Only disconnect and reconnect wires for injection and ignition system, including test leads, when the ignition is turned off.*

When removing and installing components from full or partially full fuel tanks, observe the following:

- ♦ *The fuel tank must only be partially full. How much fuel can remain in the fuel tank may be read in the respective work description. Empty the fuel tank if necessary.*
- ♦ *Before starting work, switch on the exhaust extraction system and place an extraction hose close to the installation opening of the fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a*

radial fan (as long as motor is not in air flow) with a displacement greater than 15 m³/h can be used.

- *Prevent fuel from contacting the skin! Wear fuel-resistant gloves!*

When servicing the engine control module (ECM), it may be necessary to use a heat gun. The heat gun, shear bolts, and parts of the protective housing will become extremely hot. Use extreme caution when working with or handling these parts to avoid personal injury.

Observe operating instructions when working with a heat gun. To prevent damage (burning) to the wiring and harness connections, insulation and the electronic components, perform outlined work steps exactly!

The cooling system is under pressure. To avoid scalding, use caution when opening the cooling system and servicing cooling system components!

Caution

The battery must only be disconnected and connected with the ignition switched off. Otherwise, the engine control module (ECM) can be damaged.

The use of nails, paper clips, or another unauthorized materials to back-probe harness connectors is strictly prohibited and may cause damage to the harness connectors, terminal ends or to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all harness connectors.

Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burned in the engine and will damage the oxygen sensors.

Secure all hose connections with the correct hose clips (the same as original equipment).

If engine is to be cranked without starting (for example; as part of a compression test), remove the fuses for the voltage supply of ignition coils and the fuel injectors.

An electrostatic charge can lead to functional problems of electrical components of the engine, transmission and selector lever mechanism. Touch a grounded object, e.g. a water pipe or a hoist, before working on electrical components.

Do not make direct contact with harness connector terminals.

Use only gold-plated terminals when servicing any component with gold-plated harness connector terminals.

1.2 Clean Working Conditions

Even minor contaminations can lead to malfunctions in the fuel injection system. When working on the fuel supply/injection system, pay careful attention to the following rules of cleanliness:

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place removed parts on a clean surface and cover. Use lint-free cloths.
- Carefully cover opened components or seal, if repairs are not performed immediately.

- When the system is open, do not work with compressed air. Do not move vehicle unless absolutely necessary.
- Install clean components: Remove the parts being replaced immediately prior to installation of the new parts. Do not use parts that have been stored unpacked (e.g. in tool boxes etc.).
- Electrical connectors that have been disconnected: Protect from dirt and moisture. Make sure connections are clean and dry when reconnecting.

1.3 High Voltage System General Warnings

Before performing any work on the high voltage system, always check with the importer if there are any questions regarding the terms “technician trained in electrical systems”, “high voltage technician”, “high voltage expert”, “high voltage systems”, or “hybrid systems”. Qualifications necessary for most of these terms are also provided below ⇒ page 9 .

Before beginning work on the high voltage system, a high voltage technician ⇒ page 9 , must de-energize the high voltage system. Refer to appropriate repair manual for high voltage system de-energizing.

For a list of work procedures requiring the high voltage system to be de-energized, refer to the tables listed below in: Working on the High Voltage System, Conventional Work Near High Voltage Components, and General Work ⇒ page 6 .

> **WARNING**
>
> *Read and follow the information below when de-energizing the high voltage system to reduce the risk of fatal injury.*
>
> - *Only a qualified technician (high voltage technician) should disable the high voltage system.*
> - *The high voltage technician (HVT) makes sure the system is de-energized and cannot be re-energized again.*
> - *The high voltage technician assures that the system cannot be re-energized again by safely storing the key, the High Voltage System Maintenance Connector -TW- and the pilot line connector.*
> - *The high voltage technician (HVT) puts a sign on the vehicle saying the voltage is disabled.*
> - *Only hybrid electrically instructed persons may perform all work (maintenance, tire changing, Convenience System) on vehicles with a high voltage system. If there is any uncertainty, discuss with the responsible high voltage technician.*
> - *A high voltage technician must disable the system before any work can be performed on the high voltage electrical system or any other service work to the body.*
> - *Only a high voltage expert (HVE) may perform repairs to the vehicle if it is not possible to disable the high voltage electrical system.*
> - *Individuals with electrical medical equipment must not work on vehicles with a high voltage electrical system. Examples of electrical medical equipment include pain medication pumps, implanted heart defibrillators, pacemakers, insulin pumps and hearing aids.*

WARNING

Working with high voltage cables:

- *Do not support yourself or lay tools on the high voltage cables or on any of its components.*
- *When working near high voltage components and high voltage cables, do not use tools that generate heat, that have sharp edges or that are used for cutting or shaping, such as welding, soldering, hot air or thermal adhesive equipment.*
- *When working near high voltage components and high voltage cables, do not use tools that generate heat such as welding, soldering, hot air or thermal adhesive equipment.*
- *Do not excessively bend or flex high voltage cables.*
- *Always contact a high voltage technician (HVT) if there are questions or if something is not clearly understood.*

Check the contact surfaces on the potential equalization cables before installation.

The contact surfaces must be clean. There must be no rust or grease on them.

Follow all guidelines for clean working conditions.

Observe the following precautions when working on the high voltage system:

- Only technicians who are trained in electrical systems should work on high voltage system (hybrid) vehicles.
- When working on a hybrid vehicle, always inspect the hybrid components in the area where the work is being performed.
- Do not excessively bend or flex high voltage cables.
- Always contact a high voltage technician or a high voltage expert specializing in electrical systems if something is not understood or if there are questions.
- All the work described below is referencing removing, installing and replacing the individual components.

Working on the High Voltage System

During the Following Work	Minimum Qualifications, refer to ⇒ page 9
De-energizing the high voltage system	High voltage technician
Re-energizing the high voltage system	High voltage technician

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Electro-Drive Drive Motor -V141-	X		Technician trained in electrical systems
Electric Drive Power and Control Electronics -JX1-	X		Technician trained in electrical systems

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
High Voltage System Maintenance Connector -TW-		X	Technician trained in electrical systems
Electric A/C Compressor High Voltage Cable -P3-	X		Technician trained in electrical systems
Drive Motor High Voltage Wiring Harness -PX2-	X		Technician trained in electrical systems
High Voltage Wiring Harness For High Voltage Battery -PX1-	X		Technician trained in electrical systems
Hybrid Battery Unit -AX1-, Removing and Installing	X		Technician trained in electrical systems
Charging the Hybrid-Battery -A38- with High Voltage Battery Charger -VAS6565-	X		High voltage technician
Battery Regulation Control Module -J840-	X		High voltage technician
Battery Fan 1 -V457-		X	Technician trained in electrical systems
Air guides next to the Hybrid Battery Unit -AX1-		X	Technician trained in electrical systems
Air guides under the Hybrid Battery Unit -AX1-	X		Technician trained in electrical systems
Electrical A/C Compressor -V470-	X		Technician trained in electrical systems
Drive Motor Temperature Sensor -G712-	X		Technician trained in electrical systems
Drive Motor Rotor Position Sensor 1 -G713-	X		Technician trained in electrical systems
Three-Phrase Current Drive -VX54-	X		Technician trained in electrical systems
Electrical Drive Button -E656-		X	Technician trained in electrical systems
Fuse Electrical A/C Compressor -V470- in Electric Drive Power and Control Electronics -JX1-	X		Technician trained in electrical systems
Potential equalization cable (Ground [GND] wires)	X		Technician trained in electrical systems
Working on the coolant circuit for the high voltage components	X		Technician trained in electrical systems
Measuring insulation resistance	X		High voltage technician
Working when the system is de-energized and the ignition is on	X		Technician trained in electrical systems

Conventional Work Near High Voltage Components

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Spark plugs		X	Technician trained in electrical systems
Catalytic converter		X	Technician trained in electrical systems

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Exhaust System		X	Technician trained in electrical systems
Coolant reservoir		X	Technician trained in electrical systems
Front brakes		X	Technician trained in electrical systems
Decoupler	X		Technician trained in electrical systems
Internal Combustion Engine, Removing and Installing	X		Technician trained in electrical systems
Transmission without Electro-Drive Drive Motor -V141-, Removing and Installing	X		Technician trained in electrical systems
Fuel Tank		X	Technician trained in electrical systems
Front subframe		X	Technician trained in electrical systems
Rear axle		X	Technician trained in electrical systems
Underbody Trim		X	Technician trained in electrical systems
Welding (Cover high voltage components with non-combustible materials and then perform a visual inspection)	X		Technician trained in electrical systems
Vehicle Body Work (Using an Alignment Bench)	X		Technician trained in electrical systems
When working near high voltage components and high voltage cables, do not use tools that generate heat, that have sharp edges or that are used for cutting or shaping, such as welding, soldering, hot air or thermal adhesive equipment (Cover high voltage components with non-combustible materials and then perform a visual inspection).	X		Technician trained in electrical systems
Left Front Headlamp -MX1-, Removing and Installing		X	Technician trained in electrical systems
Right Front Headlamp -MX2-, Removing and Installing		X	Technician trained in electrical systems
Headlamp Bulbs, Removing and Installing		X	Technician trained in electrical systems

General Work

When Working On the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
12V Battery, removing and installing		X	Technician trained in electrical systems
General controls modules and electric components, 12V, removing and installing		X	Technician trained in electrical systems

When Working On the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Fluids, coolant and fluids, draining and filling		X	Technician trained in electrical systems
Refrigerant extracting, evacuating, filling		X	Technician trained in electrical systems
Refrigerant pipes directly to the A/C compressor	X		Technician trained in electrical systems
A/C System, flushing		X	Technician trained in electrical systems
Peripheral refrigerant line (work that does not involve the A/C compressor directly without opening the refrigerant circuit, for example, loosening and tightening the refrigerant line)		X	Technician trained in electrical systems
Work with the engine raised, engine mount	X		Technician trained in electrical systems
Emissions test		X	Technician trained in electrical systems
Follow the instructions in the paint handbook when performing any paint/drying work		X	Technician trained in electrical systems

Qualification Explanation

Qualification	Area of Application
Hybrid electrically instructed person	May perform general work and Maintenance services on the vehicle. May be requested by the high voltage technician to perform mechanical work on the tension-free high voltage system.
High voltage technician (HVT)	The high voltage technician has the same authorization as a technician trained in electrical systems due to their qualifications. The high voltage technician can also: ♦ 1. De-energize the system. ♦ 2. Secure the system so that it cannot be energized again. ♦ 3. Ascertain that the system is definitely de-energized (certified measurement). ♦ 4. Assign work on the high voltage system to the hybrid electrically instructed person. ♦ 5 Put the vehicle back in operation.

Qualification	Area of Application
High voltage expert (HVE)	A high voltage expert (HVE) is actually a high voltage technician (HVT) but with an extra qualification that allows them to de-energize the high voltage system in the case that a high voltage technician is not able to perform measurements with the standard tools and equipment. The high voltage expert must continue the work if the high voltage technician does not have the authority to work on the high voltage system. The high voltage expert is responsible exclusively to de-energize the high voltage system if it cannot be de-energized by the high voltage technician using the usual means or methods.

2 Description and Operation

2.1 On Board Diagnostic Systems

On Board Diagnostics, or OBD, is an automotive term referring to a vehicle's self-diagnostic and reporting capability. OBD systems give the vehicle owner or repair technician access to the status of the various vehicle sub-systems. Modern OBD implementations use a standardized digital communications port to provide real-time data in addition to a standardized series of Diagnostic Trouble Codes (DTCs) which allow one to rapidly identify and remedy malfunctions within the vehicle. Legislation mandates a vehicle equipped with OBD-II to light up the fault indicator lamp if its emissions exceed the prevailing limit due to system malfunction.

All cars built since January 1st, 1996 (MY 1996) are equipped OBD-II systems. Manufacturers started incorporating OBD-II in various models as early as 1994; however, some early OBD-II cars (MY 1994 and MY 1995) were not 100% compliant.

2.2 Evaporative Emission System

The evaporative emission system has been designed to minimize the release of hydrocarbons from the fuel system into the atmosphere. The evaporative emission system components all work together with the ECM to prevent fuel vapor from escaping and route it to the intake manifold to be burned during normal combustion.

The leak detection system checks the integrity of the evaporative emission system by pressurizing the system.

- There are 3 different types of evaporative emission systems used. These systems are explained below.

- ⇒ D2.2.1 etection Pump (LDP) Evap System”, page 12
- ⇒ L2.2.2 eak Diagnostic Module (DM - TL) Evap System”, page 12
- ⇒ V2.2.3 acuum Leak Detection (NVLD) Evap System”, page 12
- ⇒ S2.2.4 ystem, Checking for Leaks”, page 12

2.2.1 Leak Detection Pump (LDP) Evap System

The leak detection pump (LDP) is integrated into the EVAP system and can have two functions. The LDP can:

- ♦ Pressurize the EVAP system and detect a drop in pressure that would indicate a leak.
- ♦ Function as the EVAP Canister Vent on vehicles that do not have a separate EVAP Canister Vent.

The LDP is a vacuum-driven, ECM controlled, diaphragm pump. In order to operate, the engine must be running and vacuum applied to the Vacuum Switch.

2.2.2 Tank Leak Diagnostic Module (DM - TL) Evap System

The canister purge valve can be actively checked using the Tank Leak Diagnostic Module (DM - TL). For this purpose the electric pump is shortly activated while the combustion engine is running, to build up a minor pressure in the fuel tank and monitor the pressure decay after opening the canister purge valve. Optionally as a quick pass method, the monitoring can be carried out by passively monitoring the fuel mixture deviation when the canister purge valve is opened. If a significant fuel mixture deviation is detected, the purge valve monitor passes. The Tank Leak Diagnostic Module (DM - TL) consists of an electrically operated air pump, an orifice with a defined diameter serving as a reference leak, and a change-over valve switching the air flow between the reference leak and the tank. If neither the pump nor the change-over valve is activated, the tank is ventilated through a bypass in the module.

2.2.3 Natural Vacuum Leak Detection (NVLD) Evap System

The system utilizes an engine-off natural vacuum evaporative system integrity check that tests for leaks with a diameter of 0.020 inch while the engine is off and the ignition is off. The natural vacuum leak detection (NVLD) evaporative system integrity check uses a pressure switch to detect evaporative system leaks. The correlation between the pressure and the temperature in a sealed system is used to generate a vacuum in the tank when the temperature drops. If a sufficient temperature drop is detected for a minimum time period, the vacuum level in a sealed system will exceed the threshold to close the NVLD pressure switch. Therefore, if the switch does not close under these conditions, a leak is detected. If the switch closes, the system is considered to be leak-free.

2.2.4 EVAP System, Checking for Leaks

The following procedure is used to diagnose EVAP System leaks.

Special tools and workshop equipment required

- ♦ Smoke tester.
- ♦ EVAP and Fuel Supply System Vacuum hose and line routing diagram.

Leak checking

– Using a Smoke tester, check the Evaporative Emission (EVAP) canister system for leaks.

– Always follow the manufacturers directions for the proper installation and operation of the smoke tester being used.

If a leak is detected:

– Check the fuel filler cap seal for damage and for proper installation. Replace if necessary.

– Check all hose connections of the fuel supply system and replace or repair any leaking lines.

– Check all hose connections of the EVAP system and replace or repair any leaking lines.

– Check that the seal under the locking flange is properly tightened on the fuel tank.

– Secure all hose connections using appropriate fittings for the model type.

– Replace seals and gaskets when performing repair work.

– Repair or replace any damaged component.

If no leaks are found in the EVAP system:

– Erase the DTC memory if a DTC was set. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 .

– Perform a road test to verify repair.

If a DTC was set and does not return:

Diagnosis complete. Generate readiness code. Refer to ⇒ C3.2 ode", page 22 .

If the same DTC does return and no leaks are found in the EVAP system:

– Check for any related TSB's.

– Perform the diagnostic test procedure for the suspected component.

2.3 Electronic Throttle Control (ETC) System

The electronic throttle control (ETC) system consists of the accelerator-pedal module, the engine control module (ECM), and the electronic throttle body. The electronic throttle body mainly consists of the throttle valve, the electric throttle-valve drive element, and the throttle-valve position sensor (TPS). The drive element is a DC servomotor, which acts on the throttle-valve shaft via a gear unit. The throttle-valve position sensor is a redundant sensor system that detects the position of the throttle valve. The sensors have opposite resistance curves so that the ECM can always cross check the signals to ensure the correct position of the throttle valve is always known.

The driver command is detected by a redundant sensor system in the accelerator-pedal module, and the signal is sent to the engine control module. The engine control module then determines the required throttle-valve position by performing calculations from data measured by sensors such as accelerator pedal position sensor, engine speed sensor and vehicle speed sensor. The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.

2.4 Electronic Power Control (EPC) Warning Lamp

When the ignition is switched on, the engine control module (ECM) checks the electronic throttle control system for static system integrity (e.g. circuit integrity, communications, etc); the electronic power control (EPC) warning light is turned on via the Instrument Cluster during this process. Shortly after engine

start, the EPC warning light is turned off if no malfunction in the electronic throttle control system is detected. In the event of a malfunction while the engine is running, the ECM will activate the EPC warning light via the Instrument Cluster and at the same time, a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

2.5 Engine Control Module (ECM)

The Engine Control Module (ECM) is a generic term for any embedded system that controls one or more of the electrical systems or subsystems in a vehicle. It controls a series of actuators on an internal combustion engine to ensure that driver commands (e.g. to accelerate) are translated into appropriate engine performance. It reads values from a multitude of sensors, interprets the data, and adjusts the engine actuators accordingly. The ECM also interacts with the transmission control module (TCM), ABS/traction/stability control module and other vehicle function related control systems.

ECM controlled systems and functions (performance and emission related) will be introduced in the following chapters. These include the OBD system, controller area network (CAN), throttle control module, fuel supply, ignition, variable valve timing, exhaust-gas recirculation, secondary air injection, exhaust system, and EVAP system.

2.6 Malfunction Indicator Lamp (MIL)

When the ignition is switched on, the Engine Control Module (ECM) performs checks on static system integrity (e.g. circuit integrity, communications, etc). The Malfunction Indicator Lamp (MIL) is switched on during this process via the Instrument Cluster. After engine starts, the ECM examines engine operation for potential malfunction(s) or failure(s) that can lead to increased emission values. If no malfunction is detected, the ECM switches off the MIL via the Instrument Cluster.

In the event of a malfunction during the operation of the engine, the ECM will activate the MIL via the instrument cluster and at the same time, a Diagnostic Trouble Code (DTC) is stored in the ECM memory. In OBD systems, the MIL can have up to three stages: steady, flashing and Stop Vehicle. A steady MIL indicates a minor fault (e.g. a failing oxygen sensor) whereas a flashing MIL indicates a more severe malfunction that could result in damage of engine or exhaust system components (e.g. the catalytic converter) if left uncorrected for an extended period. This would also indicate a severe fault. The three stages are 1. ON, then OFF; 2. ON steady; 3. flashing constantly. The 3rd stage indicates damage may occur and driver must stop.

2.7 Controller Area Network (CAN)

Overview

The Controller Area Network (CAN) bus is a message-based protocol that allows control units and devices to communicate with each other using a shared network. With this system, control units of the various electronic systems are no longer interconnected by multiple separate cables. This does away with a large number of electrical connections and results in a reduced likelihood of failure of the device network.

Broadcast Communication

Each of the devices on the network has a CAN circuit and is therefore is considered “intelligent”. All devices on the network see all transmitted messages. Each device can determine if a message is relevant or if it should be filtered out. This structure allows modifications to CAN networks with minimal impact. Ad-

ditional non-transmitting nodes can be added without modification to the network.

Priority

Every message has an assigned priority. If two nodes try to send messages simultaneously, the one with the higher priority gets transmitted and the one with the lower priority gets postponed. This arbitration does not affect other messages and results in non-interrupted transmission of the highest priority message

2.8 Fuel Supply

Overview

The fuel supply system delivers fuel to an internal combustion engine. With carburetors being replaced by fuel injections systems in the late 1980s and 1990s, the most common types of fuel supply system currently in use are throttle body injection (single-point injection), multiport injection (MPI) and direct injection (DI).

Fuel injectors atomize fuel because high pressure is forcing the fuel through a small nozzle in the injector into the intake air stream or the combustion chamber. This process is often controlled by the ECM and is dependent on data received from other sources (e.g. mass air flow sensor, throttle position sensor, etc.) to determine the precise amount of fuel needed for any given operating condition. The primary advantages of fuel injection over carburetor are improved fuel economy, increased power output and reduced emissions. The following sections will discuss each fuel injection concept in detail.

Throttle Body Injection

Throttle body injection uses a single electrically controlled injector at the throttle body. The fuel is drawn by an electric fuel pump out of the fuel tank and flows through a paper filter into the fuel injector. Since injection happens at the same location as the carburetor, very little engine redesign (intake manifold, fuel line routing, etc.) is necessary. The cost saving of throttle body injection compared to other fuel injection methods encouraged vast adoption in the late 1980s and early 1990s.

Throttle body injection system also inherits many disadvantages of the carburetor. One of them being the inability to precisely control the amount of fuel supplied into each cylinder, and is unable to precisely control combustion and emissions. It also restricts the design of intake manifold as any sharp bends in the intake path will cause atomized fuel to accumulate on the outer wall of the intake path. Supplying moderate engine heat to the intake manifold is also necessary to ensure that the fuel stay vaporized. This results in a relatively high intake air temperature and compromises performance.

Multiport Injection (MPI)

Multiport injection (MPI) consists of an injector for each cylinder just upstream of the intake valve. The fuel pump delivers the fuel into a high-pressure line where it flows to the fuel rail and injectors. When activated by the ECM, each injector sprays fuel at the intake port of its corresponding cylinder – this allows individual cylinders to receive the right amount of fuel in a more precisely timed manner. Sequential fuel injection mode can be applied to activate each injector individually to improve engine response. Lowered fuel consumption and emissions are also achieved.

Sequential multiport injection is still the most common fuel injection system found on most economy cars thanks to its high efficiency, control simplicity and low manufacturing cost (compared to direct injection). However, to further improve drivability

(performance) while reducing emissions and fuel consumption, direct injection becomes a superior alternative.

Direct Injection

Injectors in directly injected (DI) engines are mounted on the cylinder head and fuel is injected directly into the engine's combustion chamber. In order to overcome the pressure in the combustion chamber during compression and power stroke, injectors often operate at a primary pressure as high as 3000 psi. At such extreme pressure level, no single fuel pump can supply the required pressure directly from the fuel tank to the injectors. Instead, a low-pressure and a high-pressure system are employed. The low-pressure system principally utilizes the same fuel systems and components for multiport injected engines. The high-pressure system consists of a high-pressure fuel pump driven directly by the camshaft, a fuel rail (high-pressure accumulator), a high-pressure sensor and, depending on the system, a pressure-control valve or a pressure limiter. The injectors are operated by the ECM to send a precise amount of fuel from the high-pressure rail directly into the combustion chamber.

The distinctive difference between direct injection and other injection methods is that direct injection offers the flexibility regarding when in the combustion cycle the fuel is added and how. MPI systems can only add fuel during induction; A DI system can add fuel whenever it needs to. For example, fuel can be added during induction to create a homogeneous charge then added again after ignition to enhance power delivery under full load conditions.

VW/Audi Fuel Stratified Injection (FSI)

The goal of a stratified-charge operation is to form an ignitable mixture near the spark plug at the instant of ignition. This means that, instead of supplying the corresponding stoichiometric fuel quantity to the amount of air in the combustion chamber, the fuel interacts only with a portion of the air before it is conveyed to the spark plug. The rest of the fresh air surrounds the stratified charge allowing an ultra-lean condition with air-fuel ratio exceeding 50:1 in some instances. As less fuel is used to "burn" more air, stratified injection helps to further reduce fuel consumption when the engine is operating in low-load conditions (e.g. highway cruising). This is created by designing the combustion chamber so that a "swirling" effect of the air-fuel charge is caused.

2.9 Ignition and Timing

Ignition

A spark ignition (SI) engine requires a spark to initiate combustion in the combustion chamber. Voltage is supplied to the spark plug where the electricity will arc across a gap at a voltage as high as 100 kilovolts. The ECM determines the precise moment to fire each spark plug using ignition logic which is preprogrammed into the ECM as a function of engine speed and load. An optimally calibrated ignition system ensures consistent and reliable ignition under all conditions. Knock or misfire as a result of incorrect ignition can lead to destruction of engine components or damage of the catalytic converter.

Timing

Shifts in the moment of ignition (ignition timing) can result in increased emissions, decreased performance and fuel economy. Whereas more spark advance improves power and fuel economy, it also raises HC and NOx emissions. Excessive spark advance can cause engine knock which is potentially destructive to engines. If the ECM detects knock from a signal sent by a knock sensor, it will delay (retard) the timing of the spark. Excessive spark retard lowers power output and produces high

exhaust temperatures, which can also harm the engine. Carefully designed ignition logic provides optimum timing that best balances performance, fuel economy and emissions.

2.10 Variable Valve Timing

Engines equipped with variable valve timing provide the option of adjusting the phase of the camshaft with respect to the crankshaft. This allows the ECM to control the time at which the valves open or close, and therefore better assists engine “breathing” at various engine speeds. When engine speed increases, the duration of intake and exhaust stroke shortens so that less fresh air can be drawn into the combustion chamber and less exhaust gas can escape. In such a scenario, the ECM opens the intake valve before the exhaust gas has completely left the combustion chamber, and their considerable velocity assists in drawing in the fresh charge – this is referred to as “valve overlap”.

In addition to valve timing, some engines also employ variable valve lift that switches to a more aggressive camshaft-lobe profile as engine speed increases. A more aggressive camshaft-lobe profile actuates valves more rapidly and lifts valves to a greater magnitude in comparison to a normal camshaft-lobe profile. This improves intake and exhaust flow rate, allowing engines to raise maximum operating speed and power output.

2.11 Exhaust-Gas Recirculation (EGR) System

Exhaust-Gas Recirculation (EGR) can be utilized to control the cylinder charge and therefore the combustion process. The exhaust gas that is recirculated to the intake manifold increases the proportion of inert gas in the fresh gas filling; this results in a reduction in the peak combustion temperature and, in turn, a drop in temperature-dependent NOx emission.

Exhaust-gas recirculation is made possible by a connection between the exhaust pipe and the intake manifold. Due to the pressure differential, the intake manifold can draw in exhaust gas via this connection. Together with the exhaust-gas recirculation valve, the ECM adjusts the opening cross-section and therefore controls the partial flow tapped from the main exhaust flow. A malfunction in exhaust-gas recirculation system can result in performance loss and increased emissions. In such a scenario, the Malfunction Indicator Lamp (MIL) lights up and a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

2.12 Secondary Air Injection

Additionally injecting air into the exhaust pipe triggers an exothermic (release of heat) reaction. This leads to the combustion of HC and CO components that prevail mainly during the warm up phase. This oxidation process releases additional heat. Consequently, the exhaust gas becomes hotter, causing the catalytic converter to heat up at a faster rate. For spark-ignition engines, secondary-air injection is an effective means of reducing HC and CO emissions after starting the engine and to rapidly heat up the catalytic converter. This ensures that the conversion of NOx emissions commences earlier.

An electronically controlled valve operates the secondary-air valve (a one-way check valve). The ECM actuates the pump and the control valve, ensuring that secondary air can be injected at a defined point in time. The secondary air must also be injected as close to the outlet valve as possible in order to exploit the high temperatures to utilize the exothermic (release of heat) reaction effectively.

2.13 Exhaust Systems

Overview

There are three important functions of the exhaust system: to reduce the pollutants in exhaust gas, muffle engine combustion noise and to discharge exhaust gas at a convenient location on the vehicle (often underneath the rear bumper). A passenger-car exhaust system consists of the following; exhaust manifold, exhaust treatment components, sound absorption components and the system of pipes connecting these components.

Exhaust Manifold

The manifold is an important component in the exhaust system. It routes the exhaust gas out of the cylinder outlet ports into the subsequent exhaust system. The geometry of the manifold (i.e. length and cross-section of the individual pipes) has an impact on the performance characteristics, the acoustic behavior of the exhaust system, and the exhaust temperature. In some cases, the manifold is insulated with an air gap to quickly reach high exhaust temperature and to shorten the time taken by the catalytic converter to reach its operating temperature.

Emission Control

The primary emission control component is the catalytic converter, which breaks down the gaseous pollutants in the exhaust gas (CO, HC and NOx). Catalytic converters are installed as close as possible to the engine so that they can quickly reach their operating temperature and therefore be effective in urban driving. It also bears a sound-absorbing function, especially to the higher frequency portion of the engine combustion noise.

Sound Absorption

Mufflers dampen or absorb the noise produced by engine combustion. In principle, they can be installed at any position in the exhaust system. However, they are mostly located in the middle and rear sections of the exhaust system. Depending on the number of cylinders and engine output, generally 1 to 3 mufflers are used in an exhaust system. In V-engines, the left and right cylinder banks are often run separately, each being fitted with its own catalytic converters and mufflers. Although the aim of mufflers is to reduce noise in compliance with legislations, they can also help to create the sound specific to the type of vehicle.

2.14 SCR NOx Catalyst system

In order to convert harmful exhaust gas components (nitrogen oxides) to environmentally compliant components (nitrogen and water) by means of an SCR catalyst, a dosing valve injects the required amount of reductant into the exhaust system upstream of the SCR catalyst according to the actual demand. The SCR system is controlled and monitored by the SCR control module, which communicates with the ECM via CAN Bus. The SCR control module sends its diagnostic information to the ECM by means of CAN messages. The faults are stored in the fault memory of the ECM. Due to the additional SCR catalyst located downstream of the oxidation catalyst and the diesel particulate filter, nitrogen oxide emissions can be nearly eliminated. A urea solution is used as a reducing agent (the reducing agent is also referred to as Diesel Exhaust Fluid), which is injected into the exhaust system in small quantities. The amount of injected reductant depends on the temperature upstream of the SCR catalyst, the exhaust gas flow rate, and the raw NOx emissions. The target of the dosing strategy is to provide the SCR catalyst with a sufficient amount of reductant for all driving conditions.

- ♦ The SCR system consists of multiple components to function properly. These components are explained below.

- ⇒ R2.14.1 educing Agent Quality SensorG849 ", page 19
- ⇒ R2.14.2 educing Agent InjectorN474 ", page 19
- ⇒ R2.14.3 educing Agent Metering System Delivery UnitGX19 ", page 19
- ⇒ R2.14.4 educing Agent Metering System Pressure SensorG686 ", page 20
- ⇒ R2.14.5 educing Agent Heater Control ModuleJ891 ", page 20

2.14.1 Reducing Agent Quality Sensor -G849-

The expected quality signal is divided by the quality sensor signal. The diagnostic compares this ratio to threshold limits.

2.14.2 Reducing Agent Injector -N474-

The injection of the reductant works similarly to the injection of fuel. The SCR dosing valve injects the reductant into the exhaust gas flow upstream of the SCR catalyst. The amount of reductant that is injected is determined by the opening time of the SCR dosing valve. This opening time depends on the temperature of the exhaust gas stream upstream of the SCR catalyst, the exhaust gas flow rate and the engine's NOx emissions.

2.14.3 Reducing Agent Metering System Delivery Unit -GX19-

The delivery system, filter, pressure pump, return flow pump, damper, level and temperature sensor is an integrated module which is in the bottom of the DEF tank. The output is a multiplexed PWM signal which includes following information: DEF level and DEF temperature.

- Reducing Agent Pump -V437-
- The three-phase AC motor of the SCR dosing pump is driven by a pulse-width modulated three-phase current. The monitoring of the supply lines works in different ways, depending on whether the SCR dosing pump is turned on or off. If the SCR dosing pump is running, the current is monitored, and if the current exceeds a defined threshold value, the voltage will also be monitored. If the SCR dosing pump is off, only the voltage is monitored, which is set via the corresponding driver power stages. One phase current is used to calculate the total current while the pump is running. The monitoring of the total current and the voltage at the output terminals of the power stage for the SCR pump takes place in the SCR control module, which transmits the corresponding fault messages to the ECM, where the fault is stored in the fault memory.
- Reducing Agent Return Flow Pump -V561-
- To avoid crystallization of urea after long vehicle parking and freezing of urea under very cold conditions the backflow pump is used to empty the urea lines after each engine stop during keep alive time.
- Reducing Agent Reservoir Sensor -G697-
- To monitor the fluid level in the reductant tank, a fluid level sensor is used, which gathers information on the fluid level with the help of a Reed switch. Each voltage value transmitted by the fluid level sensor corresponds to one defined fluid level. Some SCR systems will receive an ultrasonic level sensor, which is able to display continuously the tank level over the whole range from full to empty tank warning level. Therefore refilling detection is always possible if a minimum

of about 1 gallon is refilled. This sensor sends an ultrasonic impulse and receives the echo which is reflected at the DEF surface. The time between sending and receiving the impulse correlates with the DEF level. The sensor sends a multiplex PWM-signal (tank level and temperature) to the ECU. This signal contains status and fault information about the level signal (frequency, duty cycle). The signal is evaluated by the sensor driver. The driver information is used by several monitoring functions.

- Reducing Agent Temperature Sensor -G685-
- In order to check the temperature value provided by the SCR tank temperature sensor, a comparison with the ambient air temperature is carried out. If this comparison raises doubt about the correctness of the reductant temperature value and the ambient air temperature is less than a defined threshold value, the SCR tank heater is commanded on and at the same time the increase of the reductant temperature value is monitored. This is to make sure that the comparison of the SCR tank temperature and the ambient air temperature does not produce a wrong result due to a potentially frozen reductant.

2.14.4 Reducing Agent Metering System Pressure Sensor -G686-

The monitor checks if the pressure values measured in the SCR line before the pressure buildup phase are within the physically possible range. The pressure sensor measures the existing pressure in the SCR line and transmits the values to the SCR control module which then transmits them to the ECM where the pressure values are monitored.

2.14.5 Reducing Agent Heater Control Module -J891-

- Reducing Agent Tank Heater (Heating Circuit 1) -Z102-
- Reducing Agent Pump Heater (Heating Circuit 2) -Z103-
- Reducing Agent Line Heater (Heating Circuit 2) -Z104-

The SCR system contains a heater for the tank and the dosing module, including the supply line, since the reductant freezes at temperatures below 11 degrees Celsius. The electric resistance heater thaws the reductant so that it is ready for dosing. The SCR dosing line heater circuit has a high-side driver and a low-side driver, the current of which can be monitored separately. The advantage of this is that, when a short circuit is detected in one, the other drivercan be switched off to ensure component protection. The SCR heater additionally has pull-up and pull-down resistors, which are used to monitor the lines when the heater is not active. For this purpose, a transistor is used to switch defined voltage levels via high Ohmic resistors (pull-up, pull-down) and the voltage of the corresponding lines is monitored. The circuit monitoring of the SCR dosing line heater takes place in the SCR control module, which transmits the fault messages to the ECM, where the corresponding fault is stored in the fault memory.

3 Diagnosis and Testing

3.1 Preliminary Check

Note

- *Before performing any pin point test or component diagnosis, a Preliminary Check must be performed.*
- *Check for Technical Bulletins that may supersede any information included in the repair manual or GST Manual.*

- For Electrical Testing: Refer to ⇒ page 21 .
- For Fuel System Mechanical Testing: Refer to ⇒ page 22 .
- For Oxygen Sensor Preliminary Tests: Refer to ⇒ page 22 .

Electrical Testing

Step	Procedure	Result / Action to Take
1	• CONNECT: Scan Tool. • IGNITION: ON. • CHECK: For stored or related DTCs. – Were any other DTCs stored?	– YES: ♦ GO TO: Step 2 ⇒ page 21 . – NO: ♦ GO TO: Step 3 ⇒ page 21 .
2	• Repair these DTCs first before performing any of the following steps.	♦ GO TO: Proper Diagnostic procedure per the stored DTC. Refer to ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .
3	• Using the Scan Tool, erase the DTC memory. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . • Perform a road test to attempt to duplicate the customers complaint. – Does DTC return?	– YES: ♦ GO TO: Step 4 ⇒ page 21 . – NO: ♦ GO TO: Step 5 ⇒ page 21 .
4	• Perform the diagnostic procedure for that DTC.	♦ GO TO: Proper Diagnostic procedure per the stored DTC. Refer to ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .
5	• FAULT: Intermittent or a sporadic condition. • CHECK: Suspected components. • PERFORM: Visual Inspection of wiring and components. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector.	♦ Perform a road test to verify the repair. ♦ Generate readiness code. Refer to ⇒ C3.2 ode”, page 22 .

Fuel System Mechanical Testing

Check the following items for possible mechanical delivery deficiency:

- Fuel level in tank is too low.
- Fuel lines pinched.
- Fuel filter plugged.
- Fuel pump delivery unit internal leak.
- Clogged injectors.
- Poor fuel quantity delivery. Refer to appropriate repair manual.

Oxygen Sensor Preliminary Tests

Check for the following conditions which can cause Oxygen Sensor Faults to set without requiring Oxygen Sensor replacement:

Common issues for lean faults:

- ♦ Vacuum leaks - check for failed or loose vacuum lines, leaking intake gaskets, or any other source of un-metered air leaks (leaks after the Mass Air Flow Sensor).
- ♦ Restricted fuel filter or bent/pinched fuel system lines.
- ♦ Incorrect input from other sensors, such as the Mass Air Flow Sensor, which may not always set a fault.
- ♦ Engine misfire.
- ♦ Exhaust leaks.
- ♦ Camshaft timing.

Common issues for rich faults:

- ♦ Leaking or faulty fuel injector.
- ♦ Fuel injector driver shorted in ECM, or wiring short for injectors (short to ground).
- ♦ Leaking or faulty fuel pressure regulator or restricted return line.
- ♦ Faulty fuel pump or fuel pump driver module.
- ♦ Incorrect input from other sensors, such as the Mass Air Flow Sensor, which may not always set a fault.
- ♦ Aftermarket components or performance chips.
- ♦ Camshaft timing.

3.2 Readiness Code

⚠ Caution

When performing the Readiness drive cycle operation, pay strict attention to driving conditions and observe and obey all posted speed limits.

Readiness code description

Diagnostics are performed at regular intervals during normal vehicle operation. After repairing an emissions related system, a readiness code is generated by road testing the vehicle.

If a malfunction is recognized during the drive cycle, it will be stored in the DTC memory.

The OBD drive cycle operation will be monitored with a hand held diagnostic tool. Consult the manufacturer's instruction manual for correct tool operation.

The readiness code is erased every time the DTC memory is erased or any time the battery is disconnected. If the DTC memory has been erased or the battery is disconnected, a new readiness code must be generated.

Only erase the DTC memory if a DTC has been stored.

General recommendations

Most monitors will complete easier and quicker using a “steady-foot” and “smooth” acceleration during the drive cycle operation.

Operating conditions

For the EVAP monitor test, the coolant temperature and the ambient air temperature must be between 10° C and 35° C with a difference between them no greater than 4° C. The ambient air temperature must not change more than 4° C during the drive cycle procedure (e.g. when driving out of a heated workshop in the winter).

Note

Do not assume that the scan tool ID and engine code are correct if the scan tool communicates. The scan tool does not use the ID to establish communication—the units are automatically identified.

Test requirements

- NO DTC in memory.
- Switch OFF all electrical and electronic accessories.
- Necessary driving speed: 50 – 70 mph.
- Drive profile takes approximately 60 – 90 min.

Readiness Drive Cycle Procedure

– CONNECT: Scan Tool.

Step	Procedure	Result / Action to Take
1	Activate Monitors: • START: Engine and idle for 2 – 3 min.	♦ Monitoring Active. ♦ Executes Misfire Monitoring.
2	O2 Sensor Monitoring: • DRIVE: Vehicle at 45 – 55 mph for a continuous 7 minute period. Avoid stopping.	♦ Executes O2 Sensor Monitoring. ♦ Executes Fuel Trim Monitoring. ♦ Executes EVAP Monitoring.
3	Fuel Cut-Off Monitoring: • ACCELERATE: Vehicle to an engine speed of 5,000 RPM; lift off the throttle until the engine speed is around 1,200 RPM.	♦ Fuel Cut-Off Monitoring Ready.

Step	Procedure	Result / Action to Take
4	Catalyst Monitoring: • ACCELERATE: Vehicle smoothly to 60 – 65 mph, cruise at a constant speed for 5 min.	♦ Executes Catalyst Monitoring. ♦ Executes O2 Sensor Monitoring. ♦ Executes Fuel Trim Monitoring. ♦ Executes Misfire Monitoring. ♦ Executes EVAP Monitoring.
5	Secondary Air Injection, EVAP Monitoring: • DRIVE: Vehicle for 30 – 40 min. at a constant speed of 50 – 70 mph in high gear for 2 min with no coasting.	♦ Executes Secondary Air Injection Monitoring. ♦ Executes EVAP Monitoring. • Check the status of the readiness code.

– If any engine monitor fails the drive cycle test. Repeat the drive cycle test until all engine monitors have successfully run through and passed.

Note

- *When repeating the drive cycle operation for a failed evaporative or thermostat monitor, allow the engine to cool until the coolant temperature and the ambient air temperature are between 10° C and 35° C with a difference between them no greater than 4° C and then repeat the drive cycle operation.*
- *Depending on the scan tool used, the readiness code status may be displayed as complete, passed or OK. At an ambient air temperature < 7° C, the setting of the readiness for the NOx catalytic converter test is delayed. Here the vehicle must be driven considerably longer.*

Readiness Codes and Monitoring Completed

1 - If any engine monitor fails the drive cycle test, repeat the drive cycle test until all engine monitors have successfully run through and passed.

2 - If the drive cycle operation fails again:

3 - Check the DTC memory for stored DTCs.

4 - Repair the vehicle if necessary.

5 - Repeat the drive cycle operation until all engine monitors have successfully run through and passed.

6 - Remove the scan tool and switch the ignition off.

3.3 Diagnostic Modes 01 - 09

The information provided in Modes 01 through 0A displays the various levels of emission related data that may be monitored, as well as the ability to retrieve and read stored DTCs, erase stored DTCs, generate readiness codes, and select the various PIDs and Test IDs used within the modes to monitor the engine, and emission related component parameters.

- ⇒ M3.3.1 ode 01 - Read Current System Data”, page 25
- ⇒ M3.3.2 ode 02 - Read Operating Conditions”, page 26
- ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28
- ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29

- ⇒ M3.3.5 ode 05 - Read Oxygen Sensor Monitoring Test Results”, page 30
- ⇒ M3.3.6 ode 06 - Read Test Results for Specific Diagnostic Functions, 2013 – 2014 MY”, page 30
- ⇒ M3.3.7 ode 06 - Read Test Results for Specific Diagnostic Functions, 2015 MY”, page 40
- ⇒ M3.3.8 ode 06 - Read Test Results for Specific Diagnostic Functions, 2016 MY”, page 47
- ⇒ M3.3.9 ode 07 - Read Faults Detected During the Current or Last Driving Cycle”, page 54
- ⇒ M3.3.10 ode 08 - Request Control of On-Board System, Test or Component”, page 54
- ⇒ M3.3.11 ode 09 - Read Vehicle Information”, page 55
- ⇒ M3.3.12 ode 0A - Check Permanent DTC Memory”, page 56

3.3.1 Diagnostic Mode 01 - Read Current System Data

Note

Depending on scan tool and protocol used, the information in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Test requirement

- Coolant temperature at least 80° C.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 1: Obtain data.”.

– From the following table, select the desired “PID” that is to be monitored, e.g. “PID $05 Coolant Temperature”.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$01:	Monitoring status since erasing DTC memory
$03:	Condition of fuel system
$04:	Calculated load value
$05:	Coolant temperature
$06:	Short term air fuel ratio
$07:	Long term air fuel ratio
$0B:	Intake Manifold Absolute Pressure
$0C:	Engine RPM
$0D:	Vehicle speed

PID	Component or System
$0E:	Ignition timing advance for #1 cylinder
$0F:	Intake air temperature
$11:	Absolute throttle position
$13:	Oxygen Sensor Bank 1 Sensor 1
$15:	Oxygen Sensor Bank 1 Sensor 2
$1C	OBD Requirements
$1F:	Time since engine start
$21:	Distance driven with MIL ON
$2E:	Commanded evap purge
$2F:	Fuel Level Input
$30:	Warm up counts after MIL erased
$31:	Distance driven after erasing DTC memory
$33:	Barometric pressure
$34:	Heater current Bank 1 Sensor 1
$3C:	Calculated catalyst temperature
$41:	Monitor status current drive cycle
$42:	Control module voltage
$43:	Absolute load value
$44:	Fuel/Air Commanded Equivalence Ratio
$45:	Relative throttle valve position
$46:	Ambient temperature
$47:	Throttle valve position 2 absolute
$49:	Accelerator pedal position 1 absolute
$4A:	Accelerator pedal position 2 absolute
$4C:	Specified throttle valve position
$51	Type of fuel currently being used
$56:	Offset oxygen sensor regulation after catalytic convertor
$6D:	Fuel Pressure Control System

– Switch the ignition off.

3.3.2 Diagnostic Mode 02 - Read Operating Conditions

When an emissions-related fault (pending DTC, visible in mode 07) is first detected, operating conditions are stored. Mode 02 makes it possible to access this freeze frame data as soon as this fault is shown in mode 03. Each control module only shows freeze frame data for one fault via mode 02. Therefore, there are two priority levels. If there is a malfunction with higher priority, the freeze frame data is overwritten.

– Fault with higher priority: Misfire malfunction or fuel trim malfunction.

– Fault with normal priority: All other emissions-related faults.

Note

Depending on scan tool and protocol used, the information in diagnostic mode 02 may be referred to by different names such as Test-ID, Hex-ID, Component-ID, or On-Board Diagnostic Monitor Identifier (OBDMID).

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

Note

If the engine does not start, crank the engine using starter for at least 5 seconds, do not switch the ignition off afterward.

– Select “Diagnostic Mode 2: Obtain operating conditions.”.

– From the following table, select the desired “PID”, e.g. “PID $05 Coolant Temperature” that is to be monitored.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$02:	DTC which triggered Freeze Frame data
$03:	Fuel system status
$04:	Calculated load value
$05:	Coolant temperature
$06:	Short term air fuel ratio
$07:	Long term air fuel ratio
$0B:	Intake Manifold Absolute Pressure
$0C:	Engine RPM
$0D:	Vehicle speed
$0E:	Ignition timing advance for #1 cylinder
$0F:	Intake air temperature
$11:	Throttle valve position 1 absolute
$1F:	Time since engine start
$2E:	Commanded evap purge
$2F:	Fuel Level Input
$33:	Barometric pressure
$42:	Control module voltage
$43:	Absolute load value
$44:	Commanded equivalence ratio
$45:	Relative throttle valve position
$46:	Ambient temperature
$47:	Throttle valve position 2 absolute
$49:	Accelerator pedal position 1 absolute
$4A:	Accelerator pedal position 2 absolute
$4C:	Specified throttle valve position
$51	Type of fuel currently used
$56:	Offset oxygen sensor regulation after catalytic convertor

PID	Component or System
$6D:	Fuel Pressure Control System

– Switch the ignition off.

3.3.3 Diagnostic Mode 03 - Read DTC Memory

Diagnostic Mode 03 makes it possible to read emissions-related faults (confirmed DTCs; faults which have activated the MIL) in the ECM and in the TCM.

When the ECM recognizes an emissions-related fault in two consecutive drive cycles, it sends a request to the instrument cluster over the CAN to turn on the malfunction indicator lamp. If an electronic throttle malfunction is recognized, the ECM will send a request to the instrument cluster over the CAN to turn on the electronic power control warning lamp.

The DTCs are sorted by SAE code with the DTC tables consisting of a 5-digit alphanumeric value.

Note

Depending on the scan tool and protocol used, diagnostic mode 03 and the information provided may be referred to by a different name.

The following tables provide a breakdown and explanation of the DTC code.

P-Codes

Component group					
P	x	x	x	x	DTC for the drivetrain
Norm-Code					
P	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts
P	1	x	x	x	Additional emission relevant DTCs provided by the manufacturer
P	2	x	x	x	DTCs defined by SAE with specified texts, from MY 2000
P	3	x	x	x	Additional emission relevant DTCs provided by the manufacturer from MY 2000

Component group					
Repair group					
P	x	0	x	x	Fuel and air mixture and additional emission regulations
P	x	1	x	x	Fuel and air ratios
P	x	2	x	x	Fuel and air ratios
P	x	3	x	x	Ignition system
P	x	4	x	x	Additional exhaust system
P	x	5	x	x	Speed and idle control
P	x	6	x	x	Control module and output signals
P	x	7	x	x	Transmission
P	x	8	x	x	Transmission

P	x	9	x	x	Control modules, input and output signals

U-Codes

Component group					
U	x	x	x	x	DTC for network (CAN bus)
Norm-Code					
U	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts

Procedure

– Connect the scan tool.

– Switch the ignition to the ON position.

– Select Diagnostic Mode 03: Interrogating fault memory.

– The stored DTC or DTCs will be displayed on the scan tool screen.

The following table is an example of the DTC information that may be displayed on the scan tool screen:

Indication example	Explanation
P0444	SAE Diagnostic Trouble Code
Evaporative emission canister purge regulator valve	Malfunctioning wiring path or malfunctioning component
Circuit open	Malfunction type as next

– Refer to the DTC tables for the diagnostic repair procedures.

– Switch the ignition off.

3.3.4 Diagnostic Mode 04 - Erase DTC Memory

Diagnostic Mode 04 makes it possible to erase the DTC memory and to reset all emissions-related diagnostic data. In that way, all faults in the DTC memory in the ECM and TCM are erased. The adaptation values may also be reset.

Emissions-related diagnostic data includes (as applicable):

♦ - MIL status

♦ - Number of DTCs

♦ - Readiness bits

♦ - Confirmed DTCs

♦ - Pending DTCs

♦ - DTC that belongs to freeze frame

♦ - Freeze frame data

♦ - Test results of specific diagnostic functions

♦ - Distance driven with MIL on

♦ - Number of warm-up cycles after erasing the DTC memory

♦ - Distance driven after erasing the DTC memory

♦ - Misfire counter

Note

Depending on the scan tool and protocol used, diagnostic mode 04 and the information provided may be referred to by a different name.

Procedure

– Connect the scan tool.

– Switch the ignition on.

– Select Diagnostic Mode 03: Interrogating fault memory.

– Then select Mode 4: Reset/delete diagnostic data.

The scan tool will display ”Diagnostic data being erased”.

– Switch the ignition off.

3.3.5 Diagnostic Mode 05 - Read Oxygen Sensor Monitoring Test Results

Note

Mode 05 may not be supported on all systems. On systems where Diagnostic Mode 05 is not supported, refer to Diagnostic Mode 6 for oxygen sensor monitoring test results.

Test Requirements

– No Test requirements are available for this powertrain.

Function Test

– No Function Tests are available for this powertrain.

3.3.6 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, 2013 – 2014 MY

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.

The min & max values for each individual test in Mode 06 represent the min & max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process.

For example; GST manual documentation will show the value as 0.3499 (units) while the scan tool will display the same value as 0.35 (units).

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID),

On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.
- Coolant temperature at least 80° C.

Work procedure

– Connect the scan tool.

– Start the engine and let run at idle speed.

– Select Mode 6: Check test the results of components that are not continuously monitored.

Select the desired Test-ID.

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all "Test-IDs" that may be selected.

Monitor-ID (Hex-ID)	Component or System
$01: ⇒ page 31	Oxygen Sensor Monitor Bank 1 - Sensor 1
$02: ⇒ page 32	Oxygen Sensor Monitor Bank 1 - Sensor 2
$03: ⇒ page 33	Oxygen Sensor Monitor Bank 1 - Sensor 3
$21: ⇒ page 33	Catalytic Converter Monitoring
$35: ⇒ page 34	Camshaft Adjustment / VVT Bank 1
$3A: ⇒ page 34	Fuel Tank EVAP System Integrity/Leak Test (0.90")
$3B: ⇒ page 35	Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0 mm)
$3C: ⇒ page 35	Fuel Tank EVAP System Integrity/Leak Test (0.20/0.5 mm)
$3D: ⇒ page 36	EVAP Valve Function Check
$41: ⇒ page 36	Oxygen Sensor Heater Monitor Bank 1 - Sensor 1
$42: ⇒ page 37	Oxygen Sensor Heater Monitor Bank 1 - Sensor 2
$43: ⇒ page 37	Oxygen Sensor Heater Monitor Bank 1 - Sensor 3
$71: ⇒ page 38	Secondary Air Injection System
$A2: ⇒ page 38	Mis-Fire Cylinder 1 Data
$A3: ⇒ page 39	Mis-Fire Cylinder 2 Data
$A4: ⇒ page 39	Mis-Fire Cylinder 3 Data
$A5: ⇒ page 40	Mis-Fire Cylinder 4 Data

Monitor-ID $01: Oxygen Sensor Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select "Mode 6: Check test the results of components that are not continuously monitored".

Select "Monitor-ID $01".

– Select the desired "Test-ID".

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$83	P0133	Response Check Bank 1 Sensor 1.	0.250 V	1.999 V	Refer to DTC P0133 in the DTC summary table. ⇒ page 68 .
$84	P2195 / P2196	Front to rear rationality Bank 1 Sensor 1.	-0.080 V	0.080 V	Refer to DTC P2195 / P2196 in the DTC summary table. ⇒ page 115
$89	P0133	Signal dynamic Bank 1 Sensor 1.	0.250 V	1.999 V	Refer to DTC P0133 in the DTC summary table. ⇒ page 68 .
$8A	P2195	Oxygen Sensor Lean Fault Detection Bank 1 - Sensor 1	-32.768	0.890	Refer to DTC P2195 in the DTC summary table. ⇒ page 115 .
$8B	P2196	Oxygen Sensor Rich Fault Detection Bank 1 - Sensor 1	1.060	32.767	Refer to DTC P2196 in the DTC summary table. ⇒ page 115

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $02: Oxygen Sensor Monitor Bank 1- Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID $02”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$05	P013A	Deceleration test - O2 transient time.	0 Sec.	0.500 Sec.	Refer to DTC P013A in the DTC summary table. ⇒ page 70 .
$81	P2271	Output Voltage rich during decel.	0 V	0.8018 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 118
$82	P2270	Output Voltage lean during accel.	0.5980 V	1.1306 V	Refer to DTC P2270 in the DTC summary table. ⇒ page 118
$8A	P2271	Deceleration test response time.	0 V	0.1495 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 118
$8E	P2270	Oxygen Sensor Maximum Oscillation Voltage	0.75200 V	7.99 V	Refer to DTC P2270 in the DTC summary table. ⇒ page 118
$8F	P2271	Oxygen Sensor Minimum Oscillation Voltage	0 V	0.15100 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 118

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding

diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory", page 28 .

– Switch the ignition off.

Monitor-ID $03: Oxygen Sensor Monitor Bank 1 - Sensor 3

– Connect the scan tool.

– Start the engine and run at idle.

– Select "Mode 6: Check test the results of components that are not continuously monitored".

Select "Monitor-ID $03".

– Select the desired "Test-ID".

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$05	P0145	Deceleration test - O2 transient time.	0 m/ Sec.	1.200 Sec.	Refer to DTC P0145 in the DTC summary table. ⇒ page 72
$81	P2275	Output Voltage rich during decel.	0 V	0.8018 V	Refer to DTC P2275 in the DTC summary table. ⇒ page 119
$82	P2274	Output Voltage lean during accel.	0.5980 V	1.1306 V	Refer to DTC P2274 in the DTC summary table. ⇒ page 118
$8A	P2275	Deceleration test response time.	0.000 V	0.1495 V	Refer to DTC P2275 in the DTC summary table. ⇒ page 119
$8E	P2274	Oxygen Sensor Maximum Oscillation Voltage	0.6980 0 V	7.99 V	Refer to DTC P2274 in the DTC summary table. ⇒ page 118
$8F	P2275	Oxygen Sensor Minimum Oscillation Voltage	0 V	0.1510 0 V	Refer to DTC P2275 in the DTC summary table. ⇒ page 119

– If any of components or systems fail to meet the specified values. Refer to Diagnostic "Mode 03: Interrogating Fault Memory" to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory", page 28 .

– Switch the ignition off.

Monitor-ID $21: Catalytic Converter Monitoring

– Connect the scan tool.

– Start the engine and run at idle.

– Select "Mode 6: Check test the results of components that are not continuously monitored".

Select "Monitor-ID 21".

– Select the desired "Test-ID" .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P0420	Catalytic converter monitoring Bank 1.	100%	655.35%	Refer to DTC P0420 in the DTC summary table. ⇒ page 89 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $35: Camshaft Adjustment / IV V T Bank 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 21”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$80	P0011	V V T specified position not reached.	-32 Deg. KW	28 Deg. KW	Refer to DTC P0011 in the DTC summary table. ⇒ page 58
$81	P000 A	V V T specified position is reached too slow.	-32 Deg	28 Deg. KW	Refer to DTC P000A in the DTC summary table. ⇒ page 58

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $3A: Fuel Tank EVAP System Integrity/Leak Test (0.90”)

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3A”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81	P0455	Tank leak test: Large leak.	950 Sec.	65.535 Sec	Refer to DTC P0455 in the DTC summary table. ⇒ page 94 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $3B: Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0mm)

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3B”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81	P0442	Fuel Tank Leak Test: Small leak.	1.550 Sec.	65.535 Sec	Refer to DTC P0442 in the DTC summary table. ⇒ page 92
$86 (2013 > MY)	P0442	Fuel Tank Leak Test: Small leak.	900 Pa	8191.75 Pa	Refer to DTC P0442 in the DTC summary table. ⇒ page 92
$87 (2013 > MY)	P0442	Fuel Tank Leak Test: Long Cycle	0 mA	255.996 mA	Refer to DTC P0442 in the DTC summary table. ⇒ page 92
$88 (2013 > MY)	P0442	Fuel Tank Leak Test: Short Cycle	0 mA	255.996 mA	Refer to DTC P0442 in the DTC summary table. ⇒ page 92
$8B (2013 > MY)	P0441	Purge Valve Functional Check	0	19.98	Refer to DTC P0441 in the DTC summary table. ⇒ page 91

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $3C: Fuel Tank EVAP System Integrity/Leak Test (0.20/0.5mm)

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3C”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81	P0456	Tank leak test: Pinhole leak (0.5 mm).	4500 ms.	65535 ms	Refer to DTC P0456 in the DTC summary table. ⇒ page 95 .
$82	---	Evap system monitor OK by initial Purge Test	12 g	6553.5 g	Pass only.
$84 (2013 > MY)	P0456	Tank leak test: Very small leak	0.00000	0.17000	Refer to DTC P0456 in the DTC summary table. ⇒ page 95 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $3D: EVAP Valve Function Check

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3D”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$80	P0441	Tank vent valve check from % DTEV: Active test Air balance at idle OK, (Normal operation and short test 70).	.350	1.999	Refer to DTC P0441 in the DTC summary table. ⇒ page 91 .
$82	—	Tank vent valve check from % DTEV: Active test, Oxygen sensor regulator deviating in lean direction (can only test OK), (Normal operation and short test 70).	1	65355	Pass only.
$88 (2012 > MY)	—	Purge flow OK by deviation lambda control.	1	65355	Pass only.
$8C (2013 > MY)	P0441	Purge flow monitor valve open	0.000000 mA	4.200 to 14.000 mA	Refer to DTC P0441 in the DTC summary table. ⇒ page 91 .
$8D (2013 > MY)	P0441	Purge flow monitor valve closed	0.00000 mA	4.300 to 36.3000 mA	Refer to DTC P0441 in the DTC summary table. ⇒ page 91 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $41: Oxygen Sensor Heater Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 41”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81	P0141	Oxygen sensor heating between catalytic converter, diagnosis, Bank 1 Sensor 2 internal resistance test.	0 Ohms	4.56 k Ohms	Refer to DTC P0141 in the DTC summary table. ⇒ page 71 .
$85 (2012 > MY)	P0135	Oxygen sensor ceramic temp Bank 1 Sensor 1	715 °C	6513.5 °C	Refer to DTC P0135 in the DTC summary table. ⇒ page 69

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $42: Oxygen Sensor Heater Monitor Bank 1 - Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 42”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81	P0141	Oxygen sensor heating between catalytic converter, diagnosis, Bank 1 Sensor 2 internal resistance test.	0 Ohms	5.250 k Ohms	Refer to DTC P0141 in the DTC summary table. ⇒ page 71 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 43: Oxygen Sensor Heater Monitor Bank 1 - Sensor 3

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 42”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81	P0141 or P0147 (2012 > MY)	Oxygen sensor heating between catalytic converter, diagnosis, Bank 1 Sensor 2 internal resistance test.	0 kOhms	4.560 kOhms	Refer to DTC P0141 in the DTC summary table ⇒ page 71 , or DTC P0147 in the DTC summary table. ⇒ page 72

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $71: Secondary Air Injection System

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 42”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$82	P0491	Secondary air injection system function test.	.102 V	1.999 V	Refer to DTC P0491 in the DTC summary table. ⇒ page 96
$85	P0410	Secondary air injection pressure check.	0 kPa	5.000 kPa	Refer to DTC P0410 in the DTC summary table. ⇒ page 87
$8A	P2440	Secondary air injection leak check.	0.00	1.289	Refer to DTC P2440 in the DTC summary table. ⇒ page 128
$8C (2013 > MY)	P2440	Tightness check Bank 1.	0.00	1.340	Refer to DTC P2440 in the DTC summary table. ⇒ page 128

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $A2: Mis-Fire Cylinder 1 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A2”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0301	Misfire cylinder 1, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 81 .
$0C	P0301	Misfire cylinder 1, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 81 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $A3: Mis-Fire Cylinder 2 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6 Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A3:”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0302	Misfire cylinder 2, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 82 .
$0C	P0302	Misfire cylinder 2, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 82 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $A4: Mis-Fire Cylinder 3 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A4”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0303	Misfire cylinder 3, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 83 .

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0C	P0303	Misfire cylinder 3, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 83 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID $A5: Mis-Fire Cylinder 4 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A5”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0304	Misfire cylinder 4, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 84 .
$0C	P0304	Misfire cylinder 4, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 84 .

– Switch the ignition off.

– If any of the components or systems fail to meet the specified values, refer to Diagnostic Mode 03: Interrogating Fault Memory to check for stored DTCs or the corresponding diagnostic repair procedure.

– Switch the ignition off.

3.3.7 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, 2015 MY

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.

The min & max values for each individual test in Mode 06 represent the min & max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process.

For example; GST manual documentation will show the value as 0.3499 (units) while the scan tool will display the same value as 0.35 (units).

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.
- Coolant temperature at least 80° C.

Work procedure

– Connect the scan tool.

– Start the engine and let run at idle speed.

– Select Mode 6: Check test the results of components that are not continuously monitored.

Select the desired Test-ID.

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all “Test-IDs” that may be selected.

Monitor-ID (Hex-ID)	Component or System
$01: ⇒ page 41	Oxygen Sensor Monitor Bank 1 - Sensor 1
$02: ⇒ page 42	Oxygen Sensor Monitor Bank 1 - Sensor 2
$21: ⇒ page 43	Catalytic Converter Monitoring
$35: ⇒ page 43	Camshaft Adjustment / VVT Bank 1
$3B: ⇒ page 43	Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0 mm)
$3D: ⇒ page 44	EVAP Valve Function Check
$41: ⇒ page 44	Oxygen Sensor Heater Monitor Bank 1 - Sensor 1
$42: ⇒ page 45	Oxygen Sensor Heater Monitor Bank 1 - Sensor 2
$A2: ⇒ page 45	Mis-Fire Cylinder 1 Data
$A3: ⇒ page 46	Mis-Fire Cylinder 2 Data
$A4: ⇒ page 46	Mis-Fire Cylinder 3 Data
$A5: ⇒ page 47	Mis-Fire Cylinder 4 Data

Monitor-ID 01 ($01): Oxygen Sensor Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 01 ($01)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$83	P0133	Response Check Bank 1 Sensor 1.	0.000 V	0.799 V	Refer to DTC P0133 in the DTC summary table. ⇒ page 68
$8A	P2195	Oxygen Sensor Lean Fault Detection Bank 1 - Sensor 1	0.850 V	1.150 V	Refer to DTC P2195 in the DTC summary table. ⇒ page 115 .
$8A	P2195	Oxygen Sensor Lean Fault Detection Bank 1 - Sensor 1	-32.768 V	0.890 V	Refer to DTC P2195 in the DTC summary table. ⇒ page 115 .
$8A	P2195	Oxygen Sensor Lean Fault Detection Bank 1 - Sensor 1	0.850 V	32.767 V	Refer to DTC P2195 in the DTC summary table. ⇒ page 115 .
$8B	P2196	Oxygen Sensor Rich Fault Detection Bank 1 - Sensor 1	0.850 V	1.150 V	Refer to DTC P2196 in the DTC summary table. ⇒ page 115
$8B	P2196	Oxygen Sensor Rich Fault Detection Bank 1 - Sensor 1	1.060 V	32.767 V	Refer to DTC P2196 in the DTC summary table. ⇒ page 115
$8B	P2196	Oxygen Sensor Rich Fault Detection Bank 1 - Sensor 1	0.850 V	32.767 V	Refer to DTC P2196 in the DTC summary table. ⇒ page 115

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 02 ($02): Oxygen Sensor Monitor Bank 1- Sensor 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 02 ($02)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$05	P013A	Oxygen Sensor Transient Time Rich-Lean Bank 1 - Sensor 2	600 mV/sec.	65,534 mV/sec.	Refer to DTC P013A in the DTC summary table. ⇒ page 70
$95	P2270	Oxygen Sensor Maximum Oscillation Voltage Bank 1 - Sensor 2	0.874875 V	7.999857 V	Refer to DTC P2270 in the DTC summary table. ⇒ page 118
$96	P2271	Oxygen Sensor Minimum Oscillation Voltage Bank 1 - Sensor 2	0.0 V	0.2498773 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 118

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 21 ($21): Catalytic Converter Monitoring

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 21 ($21)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P0420	Measured OSC Compared to OSC of Borderline Catalyst Bank 1	0.0	1.0	Refer to DTC P0420 in the DTC summary table. ⇒ page 89

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 35 ($35): Camshaft Adjustment / I VVT Bank 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 35 ($35)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$80	P0011	Target Error Intake	0.0°	9.0° - 10.0°	Refer to DTC P0011 in the DTC summary table. ⇒ page 58
$81	P000 A	Slow Response Intake	15.0°	655.35°	Refer to DTC P000A in the DTC summary table. ⇒ page 58

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 3B ($3B): Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0mm)

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 3B ($3B)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$87	P0442	Rough Leak Long Cycle	15.003 - 50.003 mA	255.996 mA	Refer to DTC P0442 in the DTC summary table. ⇒ page 215
$88	P0442	Rough Leak Short Cycle	15.003 - 50.003 mA	255.996 mA	Refer to DTC P0442 in the DTC summary table. ⇒ page 215

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 3D ($3D): EVAP Valve Function Check

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 3D ($3D)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$8B	P0441	Purge Valve Functional Check	0.05	655.35	Refer to DTC P0441 in the DTC summary table. ⇒ page 91

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 41 ($41): Oxygen Sensor Heater Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 41 ($41)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$85	P0135	Oxygen Sensor Ceramic Temperature Bank 1 - Sensor 1	730.0° C	6513.5° C	Refer to DTC P0135 in the DTC summary table. ⇒ page 69

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 42 ($42): Oxygen Sensor Heater Monitor Bank 1 - Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 42 ($42)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$90	P0141	Oxygen Sensor internal Resistance Bank 1 - Sensor 2	0.0 Ohms	0.70 kOhms	Refer to DTC P0141 in the DTC summary table. ⇒ page 71

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID A2 ($A2): Mis-Fire Cylinder 1 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID A2 ($A2)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0301	Cylinder 1 Data Averaged During Last 10 Driving Cycles, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 81 .
$0C	P0301	Cylinder 1 Data Current Driving Cycle, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 81 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault

Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID A3 ($A3): Mis-Fire Cylinder 2 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6 Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID A3 ($A3)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0302	Cylinder 2 Data Averaged During Last 10 Driving Cycles, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 82
$0C	P0302	Cylinder 2 Data Current Driving Cycle, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 82

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID A4 ($A4): Mis-Fire Cylinder 3 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID A4 ($A4)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0303	Cylinder 3 Data Averaged During Last 10 Driving Cycles, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 83
$0C	P0303	Cylinder 3 Data Current Driving Cycle, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 83

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID A5 ($A5): Mis-Fire Cylinder 4 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID A5 ($A5)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0304	Cylinder 4 Data Averaged During Last 10 Driving Cycles, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 84
$0C	P0304	Cylinder 4 Data Current Driving Cycle, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 84

– Switch the ignition off.

– If any of the components or systems fail to meet the specified values, refer to Diagnostic Mode 03: Interrogating Fault Memory to check for stored DTCs or the corresponding diagnostic repair procedure.

– Switch the ignition off.

3.3.8 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, 2016 MY

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.

The min & max values for each individual test in Mode 06 represent the min & max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process.

For example; GST manual documentation will show the value as 0.3499 (units) while the scan tool will display the same value as 0.35 (units).

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

Test requirements

• Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.

• No DTCs stored in the DTC memory.

• Coolant temperature at least 80° C.

Work procedure

– Connect the scan tool.

– Start the engine and let run at idle speed.

– Select Mode 6: Check test the results of components that are not continuously monitored.

Select the desired Test-ID.

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all “Test-IDs” that may be selected.

Monitor-ID (Test-ID)	Component or System
$01: ⇒ page 48	Oxygen Sensor Monitor Bank 1 - Sensor 1
$02: ⇒ page 49	Oxygen Sensor Monitor Bank 1 - Sensor 2
$21: ⇒ page 49	Catalytic Converter Monitoring
$35: ⇒ page 50	Camshaft Adjustment / VVT Bank 1
$3B: ⇒ page 50	Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0 mm)
$3D: ⇒ page 51	EVAP Valve Function Check
$41: ⇒ page 51	Oxygen Sensor Heater Monitor Bank 1 - Sensor 1
$42: ⇒ page 51	Oxygen Sensor Heater Monitor Bank 1 - Sensor 2
$A2: ⇒ page 52	Mis-Fire Cylinder 1 Data
$A3: ⇒ page 52	Mis-Fire Cylinder 2 Data
$A4: ⇒ page 53	Mis-Fire Cylinder 3 Data
$A5: ⇒ page 53	Mis-Fire Cylinder 4 Data

Monitor-ID 01 ($01): Oxygen Sensor Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 01 ($01)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$83	P0133	Response Check Bank 1 Sensor 1.	0.000 V	0.799 V	Refer to DTC P0133 in the DTC summary table. ⇒ page 320 .
$8A	P2195	Oxygen Sensor Lean Fault Detection Bank 1 - Sensor 1	0.850 V	1.150 V	Refer to DTC P2195 in the DTC summary table. ⇒ page 414 .
$8A	P2195	Oxygen Sensor Lean Fault Detection Bank 1 - Sensor 1	0.850 V	32.767 V	Refer to DTC P2195 in the DTC summary table. ⇒ page 414 .
$8B	P2196	Oxygen Sensor Rich Fault Detection Bank 1 - Sensor 1	0.850 V	1.150 V	Refer to DTC P2196 in the DTC summary table. ⇒ page 415 .

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$8B	P2196	Oxygen Sensor Rich Fault Detection Bank 1 - Sensor 1	0.850 V	32.767 V	Refer to DTC P2196 in the DTC summary table. ⇒ page 415 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 02 ($02): Oxygen Sensor Monitor Bank 1- Sensor 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 02 ($02)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$05	P013A	Oxygen Sensor Transient Time Rich-Lean Bank 1 - Sensor 2	600 mV/sec.	65,534 mV/sec.	Refer to DTC P013A in the DTC summary table. ⇒ page 325 .
$95	P2270	Oxygen Sensor Maximum Oscillation Voltage Bank 1 - Sensor 2	0.874875 V	7.999857 V	Refer to DTC P2270 in the DTC summary table. ⇒ page 421 .
$96	P2271	Oxygen Sensor Minimum Oscillation Voltage Bank 1 - Sensor 2	0.0 V	0.2498773 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 425 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 21 ($21): Catalytic Converter Monitoring

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 21 ($21)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P0420	Measured OSC Compared to OSC of Borderline Catalyst Bank 1	0.0	0.9999811	Refer to DTC P0420 in the DTC summary table. ⇒ page 371 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 35 ($35): Camshaft Adjustment / I VVT Bank 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 35 ($35)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$80	P0011	Target Error Intake	0.0°	9.0° - 10.0°	Refer to DTC P0011 in the DTC summary table. ⇒ page 297 .
$81	P000A	Slow Response Intake	15.0°	655.35°	Refer to DTC P000A in the DTC summary table. ⇒ page 297 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID 3B ($3B): Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0mm)

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID 3B ($3B)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$87	P0442	Rough Leak Long Cycle	15.003 - 50.003 mA	255.996 mA	Refer to DTC P0442 in the DTC summary table. ⇒ page 378 .
$88	P0442	Rough Leak Short Cycle	15.003 - 50.003 mA	255.996 mA	Refer to DTC P0442 in the DTC summary table. ⇒ page 378 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding

diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory", page 28 .

– Switch the ignition off.

Monitor-ID 3D ($3D): EVAP Valve Function Check

– Connect the scan tool.

– Start the engine and run at idle.

– Select "Mode 6: Check / test the results of components that are not continuously monitored".

Select "Monitor-ID 3D ($3D)".

– Select the desired "Test-ID".

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$8B	P0441	Purge Valve Functional Check	0.05	655.35	Refer to DTC P0441 in the DTC summary table. ⇒ page 376 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic "Mode 03: Interrogating Fault Memory" to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory", page 28 .

– Switch the ignition off.

Monitor-ID 41 ($41): Oxygen Sensor Heater Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select "Mode 6: Check / test the results of components that are not continuously monitored".

Select "Monitor-ID 41 ($41)".

– Select the desired "Test-ID".

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$85	P0135	Oxygen Sensor Ceramic Temperature Bank 1 - Sensor 1	730.0° C	6513.5° C	Refer to DTC P0135 in the DTC summary table. ⇒ page 324 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic "Mode 03: Interrogating Fault Memory" to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory", page 28 .

– Switch the ignition off.

Monitor-ID 42 ($42): Oxygen Sensor Heater Monitor Bank 1 - Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select "Mode 6: Check / test the results of components that are not continuously monitored".

Select “Monitor-ID 42 ($42)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$90	P0141	Oxygen Sensor internal Resistance Bank 1 - Sensor 2	0.0 kOhms	0.70 kOhms	Refer to DTC P0141 in the DTC summary table. ⇒ page 326 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID A2 ($A2): Mis-Fire Cylinder 1 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID A2 ($A2)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0301	Cylinder 1 Data Averaged During Last 10 Driving Cycles, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 350 .
$0C	P0301	Cylinder 1 Data Current Driving Cycle, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 350 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID A3 ($A3): Mis-Fire Cylinder 2 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6 Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID A3 ($A3)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0302	Cylinder 2 Data Averaged During Last 10 Driving Cycles, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 351 .

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0C	P0302	Cylinder 2 Data Current Driving Cycle, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 351 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID A4 ($A4): Mis-Fire Cylinder 3 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID A4 ($A4)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0303	Cylinder 3 Data Averaged During Last 10 Driving Cycles, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 353 .
$0C	P0303	Cylinder 3 Data Current Driving Cycle, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 353 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ M3.3.3 ode 03 - Read DTC Memory”, page 28 .

– Switch the ignition off.

Monitor-ID A5 ($A5): Mis-Fire Cylinder 4 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID A5 ($A5)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0304	Cylinder 4 Data Averaged During Last 10 Driving Cycles, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 354 .
$0C	P0304	Cylinder 4 Data Current Driving Cycle, Only Indication (Pass)	0 - 65,535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 354 .

– Switch the ignition off.

– If any of the components or systems fail to meet the specified values, refer to Diagnostic Mode 03: Interrogating Fault Memory to check for stored DTCs or the corresponding diagnostic repair procedure.

– Switch the ignition off.

3.3.9 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle

Mode 07 makes it possible to check emissions-related faults which appeared during the current or last driving cycle (pending DTCs).

A pending DTC is saved the first time a fault is detected (output via Mode 07).

– If the fault is detected again by the end of the following driving cycle, a confirmed DTC is entered (output via Mode 03) and the MIL is activated.

– If this malfunction is not detected again by the end of the following driving cycle, the corresponding pending code will be deleted at the end of the driving cycle.

Note

Depending on the scan tool and protocol used, some of the information provided may be referred to by a different name.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

Note

If the engine does not start, crank the engine using starter for at least 5 seconds. Do not switch the ignition off afterward.

– Select Mode 7: Check test results of components that are continuously monitored.

The number of pending DTCs or 0 malfunctions detected will be displayed on the scan tool screen.

– Refer to the DTC tables for the diagnostic repair procedures.

– Switch the ignition off.

3.3.10 Diagnostic Mode 08 - Request Control of On-Board System, Test or Component

Diagnostic Mode 08 is used to control the operation of an on-board system, test or component. A Mode 8 service can be used to turn on-board system ON or OFF, or to cycle an on-board system, test or component on or off for a specific period of time. The service can also be used to request system status or to report test results.

Test requirements

- No DTCs stored in the DTC memory.
- Intake Air Temperature (IAT) maximum 60 °C.
- Coolant temperature 80 -110 °C.
- Throttle valve angle 12.0 - 16.0%.

Function test

Note

If the accelerator pedal is depressed during the test, the test will be aborted.

– Connect the scan tool.

– Start the engine and run at idle for at least 15 minutes.

– Select “Mode 8: Tank Leak Test”.

– Select “Test-ID 01: Tank Leak Test”.

– Check the specified value of the tank leak test at idle.

– The following will be displayed on the scan tool screen:

Tank leak test	Specified value
♦ Test function active ♦ Test function is being initiated, please wait ♦ Test off ♦ Test aborted	Test OK

– Switch the ignition off.

If the specified result is obtained:

System OK.

If the specified result is Not obtained:

– Repeat the tank leak test, switch the ignition off and start the engine again and let run for 15 minutes at idle.

– Switch the ignition off.

If the specified result is again Not obtained:

– A leak may be present. Refer to ⇒ S2.2.4 ystem, Checking for Leaks”, page 12 .

3.3.11 Diagnostic Mode 09 - Read Vehicle Information

Diagnostic Mode 09 makes it possible to access vehicle specific information from the control modules (where applicable).

Note

Depending on the scan tool and protocol used, Diagnostic Mode 09 and the information provided may be referred to by a different name.

Test Requirement

- No DTCs stored in the DTC memory.

Procedure

– Connect the scan tool.

– Switch the ignition on.

– Select Mode 09: Vehicle information.

– Select the desired Test ID.

– The information requested will be displayed on the scan tool screen.

The following table is a numerical list of all Test IDs that may be selected.

Test-ID	Diagnostic text
02:	Vehicle identification number e.g.
	♦ A different 17 digit number will be displayed for each vehicle
04:	Calibration identification e.g.
	♦ Engine Control Module -J623-
	♦ Transmission Control Module -J217-
06:	CVN (check sum) e.g.
	♦ EC5AE460 the check sum is different for every control module version
	♦ 000D105
08:	In Use Performance Tracking

Service $0A	Request Emission Related DTC's with Permanent Status - SUPPORTED

– Switch the ignition off.

3.3.12 Diagnostic Mode 0A - Check Permanent DTC Memory

Note

♦ *The following is a generic explanation of the requirements, coverage, and operation of Mode 0A.*

♦ *Mode 0A may only be supported exclusively by OBD control modules in US vehicles. Mode 0A may not be supported in EOBD vehicles, meaning the control module may not send a response here.*

Mode 0A - Check Permanent DTC Memory (Request emissions-related diagnostic trouble codes with permanent status after code clear)

Permanent Fault Codes From MY 2010 with Phase-In conforming to CCR 1968.2 (d)(2.2.5): 50% from MY 2010 / 75% from MY 2011 / 100% from MY 2012 The vehicle only participates in Phase-In if all of the OBD-relevant control modules in the vehicle meet these requirements.

Mode 0A enables the request of all OBD-relevant faults with the status “Permanent Fault Code”

- Permanent Fault Codes are Confirmed Fault Codes that are currently activating the MIL. That means faults that are still displayed in Mode 03 but no longer activate the MIL (History Fault Codes) are not Permanent Fault Codes.

- Permanent Fault Codes are updated in Mode 0A at the same time as NVRAM storage immediately after switching the ignition off. A newly detected Permanent Fault Code is only visible after switching the ignition off/on in Mode 0A.

- Permanent Fault Codes may only be erased in the control module after they are corrected as long as the last diagnostic result was a PASS and the MIL is no longer activated by this fault. The Permanent Fault Codes should be erased from Mode 0A at the same time the MIL switches off when the ignition is switched off/on.

- Permanent Fault Codes may not be erased by clearing the DTC memory or disconnecting the power supply. Storage in NVRAM is required.

- Permanent Fault Codes may only be erased after clearing the DTC memory under the following conditions: - As long as no FAIL diagnostic result was detected for a Permanent Fault Code - and at least one PASS diagnostic result was detected - and the Minimum Trip Conditions for a General Denominator (without considering high/ambient temperature) were met in this phase in any DCY after erasing the DTC memory.

- The engine control module relays the message “Minimum Trip conditions met” to all other OBD control modules via CAN: CAN message OBD_01, Byte 8, Bit 4: OBD_Minimum_Trip

- Permanent Fault Codes may NOT be erased if the diagnostic result is FAIL after clearing the DTC memory. A Pending Fault Code should be stored and the DTC memory line should be overwritten with new Freeze Frame data. (Exception: If the Pending Fault Code is corrected without a Confirmed Fault Code being detected, the Permanent Fault Code may also be erased under the conditions described below.)

- Permanent Fault Codes should be erased in engine control modules after Update Programming. At this time, all readiness bits (Mode 01 PID $01) must be reset to “not complete” [(g)(4.4.6)(D)]. Permanent Fault Codes should not be erased in OBD control modules with Comprehensive Components (CCM) as a single readiness bit if the identical program/data status is being programmed. If a different program/data status is being programmed, Permanent Fault Codes should be erased after Update Programming.

- The procedure in Mode 01 through Mode 09 and in the service tester is NOT affected by implementation of the Permanent Fault Codes.

Note

After MIL off during the 40 warm-up cycle self-healing process, the fault may not be reported as Permanent Fault Code anymore

Procedure

- Erasing Permanent Fault Codes after code clear Service $0A – Permanent Fault Codes: can only be erased at the end of a driving cycle (during ECM keep alive time) if all the following conditions are fulfilled:

- ERASE: Permanent Fault Codes after code clear, the vehicle needs to be driven!
- NO FAIL: DTC cleared
- MONITORS: PASS
- MINIMUM: Conditions fulfilled 600 s (cumulative) Engine running
- DRIVE: 300 s (cumulative) vehicle speed > 25 mph (40 km/h)

3.4 Engine DTC Tables

- ⇒ E3.4.1 ngine Control Module, 2013 – 2014 MY", page 58
- ⇒ E3.4.2 ngine Control Module, 2015 MY", page 132
- ⇒ E3.4.3 ngine Control Module, 2016 MY", page 297

3.4.1 Engine Control Module, 2013 – 2014 MY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P000A	Intake Camshaft Position Slow Response Bank 1	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .	• Signal change > 8 CRK ° for > 2.9 Sec. and adjustment angle >= 2.50 CRK rev.	• Time after engine start > 3 Sec. • Frequency 4 times • Frequency at cold start 2 times	14 Sec.	• 2 DCY
P0010	Intake Camshaft Position Actuator Circuit Open Bank 1	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .	Signal voltage, > 4.7 - 5.4 V	• Camshaft valve off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0011	Intake Camshaft Position Timing - Over-Advanced Bank 1	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .	• Signal change > 8 CRK ° for > 2.9 Sec. and adjustment angle < 2.50 CRK rev.	• Time after engine start > 3 Sec. • Oil temperature -48 to 143.30 °C • Frequency 4 times • Engine speed 600 to 6000 RPM	14 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0016	Crankshaft Position – Camshaft Position Correlation	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 . – Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.6.10 ngine Speed Sensor G28, Checking", page 540 .	• Permissible deviation < -11 CRK ° OR • Permissible deviation > 11 CRK °		20 rev.	• Multiple • 2 DCY
P0030	HO2S Heater Control Circuit Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	Heater voltage 4.70 - 5.40 V	• Time after engine start > 5 Sec. • Heater commanded off	0.5 Sec.	• 2 DCY
P0031	HO2S Heater Control Circuit Low Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	Heater voltage < 0 to 3.26 V	• Time after engine start > 5 Sec. • Heater commanded off	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	Signal current > 5.50 A	• Time after engine start > 5 Sec. • Heater commanded on	0.5 Sec.	• 2 DCY
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	Heater voltage, 4.50 - 5.50 V	• Time after engine start > 5 Sec. • Heater, Commanded off	0.5 Sec.	• 2 DCY
P0037	HO2S Heater Control Circuit Low Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	Heater voltage < 3.00 V	• Time after engine start > 5 Sec. • Heater, Commanded off	0.5 Sec.	• 2 DCY
P0038	HO2S Heater Control Circuit High Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	Heater current, > 2.70 - 5.50 A	• Time after engine start > 5 Sec. • Heater, Commanded on	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0068	MAF vs Throttle Position Correlation	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	Plausibility with fuel system • Load calculation < -22% Plausibility with fuel system • Load calculation > 22%	• Engine speed 1280 - 6000 RPM • ECT > 63 °C • IAT < 90 °C • Mass air flow 0 - 300 kg/h • Engine load 20 - 100% • EVAP purge valve closed • Fuel system monitor running • Lambda control closed loop	139.4 Sec.	• 2 DCY
P0070	Ambient Air Temperature Sensor Circuit	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568	Ambient air temperature < -50 °C	CAN active	6 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0071	Ambient Air Temperature Sensor Range/ Performance	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 .	• Difference in value between ECT and AAT at engine start (depending on engine off time) > 25 K and • Difference in value between AAT and IAT at engine start (depending on engine off time) > 25 K	• Engine off time > 5 hours • ECT @ engine start < 2 K minus • AAT @ engine start <= 3 K • Vehicle speed > 40 km/h minus • ECT @ time after engine start 60 Sec. • AAT @ engine start < 5.2 °C minus • AAT @ condition veh speed > 25 mph for time > 30 Sec. • IAT @ engine start < 5.2 °C minus • IAT @ condition veh speed > 25 mph for time > 30 Sec.	0 Sec.	• 2 DCY
P0072	Ambient Air Temperature Sensor Circuit Low	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 .	Ambient air temperature > 77 °C	CAN active	6 Sec.	• 2 DCY
P0087	Fuel Rail/ System Pressure - Too Low	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 .	• Fuel trim activity 0.90 - 1.15 • Pressure controller activity > 2 MPa • Difference between target and actual pressure > -16.4	• Engine speed > 600 RPM • EVAP purge adaptation < 22 • ECT >= 63 °C • IAT < 90 °C • Lambda control closed loop	5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0100	Mass Air Flow Circuit Fault	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .	MAF sensor signal 0 µs	Engine speed > 20 RPM	0.2 Sec.	• 2 DCY
P0101	Mass Air Flow Circuit Range/ Performance	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .	Mass air flow vs. • upper threshold model > 60 to 800 kg/h • lower threshold model < 0 to 400 kg/h • Load calculation > 18% • Fuel system < -18%	• Time after engine start, 150 camshaft revolutions • Throttle position < 99.6% • Engine speed 1280 - 6000 RPM • ECT > 63 °C • IAT < 90 °C • Mass air flow 0 - 450 kg/h • Engine load 20 - 100% • Lambda control closed loop • EVAP purge valve closed • No low fuel signal	2 Sec.	• 2 DCY
P0102	Mass Air Flow Circuit Low Input	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .	MAF sensor signal < 66 µs	Engine speed > 20 RPM	0.2 Sec.	• 2 DCY
P0103	Mass Air Flow Circuit High Input	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .	MAF sensor signal > 4500 µs	Engine speed > 20 RPM	0.2 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Range/ Performance	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 . If there is no fault found with the Charge Air Pressure sensor or wiring, check for any related TSB's. The Altitude (Baro) sensor is located within the ECM and will require replacement of the ECM if faulty. Check the Baro reading with a scan tool vs. actual Baro for the area. If Baro is off by more than 10%, replace the ECM. Refer to the Repair Manual.	• Difference of boost pressure signal vs altitude sensor signal > 230 hPa OR • Difference of boost pressure signal vs altitude sensor signal < -130 hPa	• Engine speed < 1000 RPM • Throttle position < 11.50%	2 Sec.	• 2 DCY
P0111	Intake Air Temperature Sensor 1 Circuit Range/ Performance	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .	• Difference in value IAT - ECT @ engine start (depending on engine off time) > 25 °C • Difference in value IAT - AAT @ engine start > 25 °C (depending on engine off time)	• Engine off time > 5 hours • ECT @ engine start < 2 K minus • AAT @ engine start <= 3 K • Vehicle speed > 40 km/h minus • ECT @ time after engine start 60 Sec. • AAT @ engine start < 5.2 °C •	0 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .	IAT > 141.0 °C		2 Sec.	• 2 DCY
P0113	Intake Air Temperature Sensor 1 Circuit High Input	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .	IAT < -46 °C		2 Sec.	• 2 DCY
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 .	• No change on signal < 2 K or • signal in range >= 89 °C with no change and signal <= 110 °C	• ECT @ start 50 - 140 °C (stuck hi) or 50.30 - 88.4 °C (stuck low) • V Temp 2: • Substitute ECT > -48 °C • Mass air flow 28 to 84 kg/h driving conditions • Veh speed 0 - 20 km/h • Mass air flow 12 - 36 and 36 - 152 kg/h • Time required > 40.0 Sec.	72 Sec.	• 2 DCY
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 . – Check the coolant thermostat. Refer to the Repair Manual.	ECT >140 °C		2 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 . – Check the coolant thermostat. Refer to the Repair Manual.	ECT < -40 °C		2 Sec.	• 2 DCY
P0121	Accelerator Pedal Position Sensor 1 / Accelerator Pedal Position Sensor 2 Circuit Range/ Performance	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	• TPS 1 - TPS 2 > 6.30% • Actual TPS 1 calculated value > TPS 2 calculated value • TPS 1 calc. value > 9.00%	• Engine speed > 480 RPM	0.3 Sec.	• 2 DCY
P0122	Accelerator Pedal Position Sensor 1 / Accelerator Pedal Position Sensor 2 Circuit Low Input	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	Signal voltage < 0.20 V		0.1 Sec.	• 2 DCY
P0123	Accelerator Pedal Position Sensor 1 / Accelerator Pedal Position Sensor 2 Circuit High Input	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	Signal voltage > 4.81 V		0.1 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0130	O2 Sensor Circuit Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	• O2S ceramic temp. < 640 °C	• Modeled exhaust temp > 300 °C • Fuel cutoff not active	12 Sec.	• 2 DCY
P0131	O2 Sensor Circuit, Bank 1 Sensor 1 Low Voltage	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	• VM > 1.75 V • UN > 1.50 V • IA or IP > 0.30 V		10 Sec.	• 2 DCY
P0132	O2 Sensor Circuit, Bank 1 Sensor 1 High Voltage	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	• VM > 3.25 V • UN > 4.40 V • IA or IP > 7 V		10 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0133	O2 Circuit Slow Response Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	Signal dynamic slope check • O2S signal front vs. modeled O2S signal ratio < 0.35 and > 0.01 • Lower value of both counters for area ratios L to R and R to L > = 5 times Oscillation check • Lambda amplitude signal > 20% • Cycles > 8 • Time lambda > lambda amplitude 400 m sec. Delay check • Delay modeled lambda signal minus measured signal > 460 m sec. • Cycles > 12	• Engine speed, 1200 - 2800 RPM • Engine load, 18 - 80% • Delta engine load <= 7.99% • Actual lambda, 0.85-1.15 • Lambda control, Closed loop • EVAP purge flow < 18- • Determination of max and min slope ratios 0.01 - 4 • O2S front - time since operation readiness > 36 Sec. • O2S ceramic temp > 715 °C • Determination of measurement window, 500 m sec. Oscillation and delay check • Lambda control, Closed loop • Engine load 20 - 80% • Engine speed 1340 - 3500 RPM • Delta engine load < 3% • Actual lambda 0.75 - 1.25	• 96 Sec. Oscillation and delay check • 200 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0135	O2 Heater Circuit Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	• Heater duty cycle, >100% • O2S ceramic temperature, < 715 °C • Time after O2S heater on 40 Sec.	• Heater control, Active • Modeled exhaust gas temp, > 300 °C • ECT at start > -11 °C • Engine shutoff time > 300 Sec.	• 40 - 55 Sec.	• 2 DCY
P0136	O2 Circuit Bank 1 Sensor 2 Malfunction	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	• Delta voltage one step at heater switching > 2.00 V • Number of checks >= 4	• Sensor voltage <= 0.40 V or 0.50 to 1.08 V.	40 Sec.	• 2 DCY
P0137	O2 Circuit Low Voltage Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	Cold condition • Signal voltage, < 0.06 V for 3 Sec. Warm condition • Signal voltage < 0.01 V • Reaction at closed loop enrichment - no reaction	• ECT at engine off, > 60 °C • ECT < 39.8 °C • Sensor voltage <= 0.40 V or 0.50 to 1.08 V Warm condition • Sensor sufficient heated if exhaust temperature >= 650 °C • Modeled exhaust gas temp. 200.006 - 800.006 °C for 60 Sec.	3 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0138	O2 Circuit High Voltage Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking”, page 569 .	Signal voltage > 1.08 V for > 5 Sec.	• Sensor voltage <= 0.40 V • Exhaust gas temp. >= 650 °C for 18 Sec.	5 Sec.	• 2 DCY
P0139	O2 Circuit Slow Response Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking”, page 569 .	• EWMA filtered transient time at fuel cutoff > 0.0 Sec. • In voltage range of 201 - 401 mV • Number of checks, >= 3	• Rich voltage enable > = 547.9 mV • Lean voltage < = 201.2 mV • Fuel cutoff active • O2S rear ready • Modeled exhaust gas temp > 400 °C • Front O2 sensor lambda signal > 2.00 V	100 Sec.	• 1 DCY
P013 A	O2 Sensor Slow Response Rich to Lean Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking”, page 569 .	• EWMA filtered max differential transient time at fuel cutoff >= 0.65 Sec. • Number of checks >= 1	• Time of fuel cutoff <= 90 Sec. • Time after last fuel cutoff >= 20 Sec. • O2S rear ready • Exhaust temp at sensor >= 385 °C	10 Sec.	• 2 DCY
P0140	O2 Circuit No Activity Detected Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking”, page 569 .	Signal voltage • Signal voltage, 0.40 - 0.60 V for > 3 Sec. Internal resistance • > 40000 ohm	• Sensor voltage <= 0.40 V or 0.50 to 1.08 V Sensor threshold. • Modeled exhaust gas temp. 700° C for > 10 Sec. • Heater power >= 50%	38 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0141	O2 Heater Circuit Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	Heater resistance, 702 - 5250 Ohm	• Heater commanded on • Modeled exhaust gas temp, 250 - 650 °C • Number of checks 10 • Engine shutoff time > 60 Sec. • Fuel cutoff not active	15 Sec.	• 2 DCY
P0142	O2 Sensor Circuit Bank 1 Sensor 3	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	• Delta voltage one step at heater > 2.0 V • number of checks, 4	• Modeled exhaust gas temp 700 °C for > 10 Sec. • Dew point exceeded and lower exhaust gas temp limit exceeded for 60 Sec.	40 Sec.	• 2 DCY
P0143	O2 Sensor Circuit Low Voltage Bank 1 Sensor 3	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	Cold/Warm condition • Signal voltage < 0.06 V for > 3 Sec.	Cold condition • Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Modeled exhaust gas temp. 700 °C for > 10 Sec. • Heater power >= 50% for > 10 Sec.	3 Sec.	• 2 DCY
P0144	O2 Sensor Circuit High Voltage Bank 1 Sensor 3	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	Signal voltage > 1.08 V for > 5 Sec.	Cold condition • Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Modeled exhaust gas temp. 700 °C for > 10 Sec. • Heater power >= 50% for > 10 Sec.	5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0145	O2 Sensor Circuit Slow Response Bank 1 Sensor 3	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	• EWMA filtered transient time at fuel cutoff > 1.2 Sec. • In voltage range of 201.2 - 401.4 mV • Number of checks, 3	• Rich voltage enable > = 548 mV • Lean voltage < = 201.2 mV • Fuel cutoff active • O2S rear ready • Modeled exhaust gas temp > 400 °C • Front O2 sensor lambda signal > 2.00 V	100 Sec.	• 2 DCY
P0146	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 3	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	• Signal voltage 0.40 - 0.60 V for > 3 Sec. • Internal resistance > 40000 Ohm	Cold condition • Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Modeled exhaust gas temp. 650 °C for > 18 Sec. • Heater power >= 50% for > 10 Sec.	38 Sec.	• 2 DCY
P0147	O2 Sensor Heater Circuit Bank 1 Sensor 3	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	• Heater (ECM internal) resistance 792 - 4560 ohm	• Modeled exhaust gas temp 250 - 650 °C • Engine shutoff time > 60 Sec. • Fuel cutoff not active • Number of checks 10 • Heater commanded on	15 Sec.	• 2 DCY
P0169	Incorrect Fuel Composition	Check for contaminated fuel, long term adaptive out of range, possible O2 sensor fault or high concentration of alcohol in fuel (above 15%).	• Fuel quantity incorrect • Fuel correction factor incorrect • Internal check failed	Engine speed > 1200 RPM	0.52 to 2.08 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0171	System Too Lean Bank 1	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the intake system for leaks, or engine gaskets, oil cap loose/missing that can allow air in the via the PCV system. – Check the vacuum lines for leaks	At idle • Adaptive value > 5.02% At part load • Adaptive value > 21%	At idle • Engine speed, 560 - 1200 RPM • Engine load, 9 - 45% • Mass air flow 5-23 kg/h • ECT > 63 °C • IAT < 90° C • Part load adaptation ready • Lambda control, Closed loop • EVAP purge valve, Closed • No low fuel signal At part load • Throttle position < 99.6% • Engine speed 1320 - 5000 RPM • Engine load 20 - 100% • Mass air flow 27 - 450 kg/h • ECT > 63 °C • IAT < 90 °C • Lambda control closed loop • EVAP purge valve closed • No low fuel signal	• 10 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0172	System Too Rich Bank 1	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .	At idle • Adaptive value < -5.02% At part load • Adaptive value < -21%	At idle • Engine speed, 560 - 1200 RPM • Engine load, 9 - 45% • Mass air flow 5-23 kg/h • ECT > 63 °C • IAT < 90° C • Part load adaptation ready • Lambda control, Closed loop • EVAP purge valve, Closed • No low fuel signal At part load • Throttle position < 99.6% • Engine speed 1320 - 5000 RPM • Engine load 20 - 100% • Mass air flow 27 - 450 kg/h • ECT > 63 °C • IAT < 90 °C • Lambda control closed loop • EVAP purge valve closed • No low fuel signal	• 10 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0190	Fuel Rail Pressure Sensor Circuit	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551	Signal voltage > 4.8 V		0.5 Sec.	• 2 DCY
P0191	Fuel Rail Pressure Sensor Circuit Range/ Performance	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551	Actual pressure > 20.6 MPa	• Time after engine start > 0 Sec. • Engine speed > 90 RPM	3 Sec.	• 2 DCY
P0192	Fuel Rail Pressure Sensor Circuit Low Input	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551	Signal voltage < 0.2 V		0.5 Sec.	• 2 DCY
P0201	Injector Circuit Open Cylinder 1	– Check the Fuel Injectors -N30-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	• Low side signal current < 2.1 A • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched on	0.5 Sec.	• 2 DCY
P0202	Injector Circuit Open Cylinder 2	– Check the Fuel Injectors -N31-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	• Low side signal current < 2.1 A • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched on	0.5 Sec.	• 2 DCY
P0203	Injector Circuit Open Cylinder 3	– Check the Fuel Injectors -N32-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	• Low side signal current < 2.1 A • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched on	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0204	Injector Circuit Open Cylinder 4	– Check the Fuel Injectors -N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	• Low side signal current < 2.1 A • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched on	0.5 Sec.	• 2 DCY
P0221	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Range/ Performance	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	• TPS 1 - TPS 2 > 6.30% • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 – calc. value > 9.00%	• Engine speed > 480 RPM	0.3 Sec.	• 2 DCY
P0222	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Low Input	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	Signal voltage < 0.20 V		0.1 Sec.	• 2 DCY
P0223	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit High Input	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	Signal voltage > 4.81 V		0.1 Sec.	• 2 DCY
P0234	Turbocharger Overboost Condition	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535	Difference of set value boost pressure vs altitude sensor signal > 260 - 1275 hPa	Altitude < 2700 m	1.2 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0236	Turbocharger Boost Sensor Circuit Range/ Performance	– Check the Charge Air Pressure Sensor - G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535	Difference of boost pressure signal vs. altitude sensor signal > 230 hPa or < -130 hPa	• Engine speed < 1000 RPM • Throttle position < 6.81%	2 Sec.	• 2 DCY
P0237	Turbocharger Boost Sensor Circuit Low	– Check the Charge Air Pressure Sensor - G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535	Signal voltage < 0.2 V	Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0238	Turbocharger Boost Sensor Circuit High	– Check the Charge Air Pressure Sensor - G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535	Signal voltage > 4.88 V	Engine speed > 80 RPM and throttle position < 6.81%	0.5 Sec.	• 2 DCY
P025 A	Fuel Pump Module Control Circuit Open	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .	Signal voltage 4.40 - 5.60 V	Engine speed > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P025C	Fuel Pump Module Control Circuit Low	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .	Signal voltage 2.15 - 3.25 V	Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P025D	Fuel Pump Module Control Circuit High	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .	Signal current > 1.10 A	Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0261	Cylinder 1 Injector Circuit Low	– Check the Fuel Injector -N30-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	Signal current < 2.1 A	• Injection valve, Commanded on • Engine speed, > 80 RPM • High side signal current, > 4.20 A	0.5 Sec.	• 2 DCY Actual TPS 2 calculated value > TPS 1 calculated value
P0262	Cylinder 1 Injector Circuit High	– Check the Fuel Injector -N30-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	Signal current > 14.70 A	• Injection valve, Commanded on • Engine speed, > 80 RPM	0.5 Sec.	• 2 DCY
P0264	Cylinder 2 Injector Circuit Low	– Check the Fuel Injector -N31-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	Signal current < 2.1 A	• Injection valve, Commanded on • Engine speed, > 80 RPM • High side signal current, > 4.20 A	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0265	Cylinder 2 Injector Circuit High	– Check the Fuel Injector -N31-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	Signal current > 14.70 A	• Injection valve, Commanded on • Engine speed, > 80 RPM	0.5 Sec.	• 2 DCY
P0267	Cylinder 3 Injector Circuit Low	– Check the Fuel Injector -N32-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	Signal current < 2.1 A	• Injection valve, Commanded on • Engine speed, > 80 RPM • High side signal current, > 4.20 A	0.5 Sec.	• 2 DCY
P0268	Cylinder 3 Injector Circuit High	– Check the Fuel Injector -N32-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	Signal current > 14.70 A	• Injection valve, Commanded on • Engine speed, > 80 RPM	0.5 Sec.	• 2 DCY
P0270	Cylinder 4 Injector Circuit Low	– Check the Fuel Injector -N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	Signal current < 2.1 A	• Injection valve, Commanded on • Engine speed, > 80 RPM • High side signal current, > 4.20 A	0.5 Sec.	• 2 DCY
P0271	Cylinder 4 Injector Circuit High	– Check the Fuel Injector -N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	Signal current > 14.70 A	• Injection valve, Commanded on • Engine speed, > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0299	Turbocharger Underboost	– Check the charge air system for proper seal. Refer to the Repair Manual. – Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535	Difference of set boost pressure vs actual boost pressure value > 150 hPa	• Engine speed > 2800 RPM • Altitude < 2700 m • Difference of set value boost pressure vs basic boost pressure value > 250 hPa • Boost pressure control active • Turbo charger bypass valve closed	6 Sec.	• 2 DCY
P0300	Random Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%	• Time from start, 0 Sec. • IAT, > -48° C • Time after engine start, Idle +/- 150 RPM and 1 cam rev. • Engine torque, > 5.47-23.4% • Camshaft revolutions 1 • Engine speed range, 440-6800 RPM • Fuel cutoff, Not active • ECT at start, > -48 °C	• 1000 Rev. • 200 Rev.	• 2 DCY • Immediate

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0301	Cylinder 1 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%	• Time from start, 0 Sec. • IAT, > -48° C • Time after engine start, Idle +/- 150 RPM and 1 cam rev. • Engine torque, > 5.47-23.4% • Camshaft revolutions 1 • Engine speed range, 440-6800 RPM • Fuel cutoff, Not active • ECT at start, > -48 °C	• 1000 Rev. • 200 Rev.	• 2 DCY • Immed.

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0302	Cylinder 2 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%	• Time from start, 0 Sec. • IAT, > -48° C • Time after engine start, Idle +/- 150 RPM and 1 cam rev. • Engine torque, > 5.47-23.4% • Camshaft revolutions 1 • Engine speed range, 440-6800 RPM • Fuel cutoff, Not active • ECT at start, > -48 °C	• 1000 Rev. • 200 Rev.	• 2 DCY • Immed.

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0303	Cylinder 3 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%	• Time from start, 0 Sec. • IAT, > -48° C • Time after engine start, Idle +/- 150 RPM and 1 cam rev. • Engine torque, > 5.47-23.4% • Camshaft revolutions 1 • Engine speed range, 440-6800 RPM • Fuel cutoff, Not active • ECT at start, > -48 °C	• 1000 Rev. • 200 Rev.	• 2 DCY • Immed.

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0304	Cylinder 4 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%	• Time from start, 0 Sec. • IAT, > -48° C • Time after engine start, Idle - 150 RPM • Engine torque, > 5.47-23.4% • Camshaft revolutions 1 • Engine speed range, 480-6800 RPM • Fuel cutoff, Not active • ECT at start, > -10.50 °C	• 1000 Rev. • 200 Rev.	• 2 DCY • Immed.
P0321	Engine Speed Input Circuit Performance	– Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.6.10 ngine Speed Sensor G28, Checking", page 540 .	• Comparison of counted teeth vs reference = incorrect • monitoring reference gap failure		1.5 Sec.	• 2 DCY
P0322	Engine Speed Input Circuit No Signal	– Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.6.10 ngine Speed Sensor G28, Checking", page 540 .	• Camshaft signal > 3 • Engine speed, no signal		2.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0324	Knock Control System Error	– Check the-Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .	• Signal fault counter (combustion) > 24 or • Signal fault counter (measuring window) > 2.00	Engine speed 2500 RPM	0.5 Sec.	• 2 DCY
P0327	Knock Sensor 1 Circuit Low	– Check the-Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .	• Lower threshold < -0.70 V or for signal range check • Lower threshold < 0 - 1.60 V	• Engine speed, > 1000 RPM or for signal range check • ECT > 41 °C • Engine load > 35 - 60% • Engine speed > 2000 RPM	0.5 Sec.	• 2 DCY
P0328	Knock Sensor 1 Circuit High	– Check the-Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .	• Upper threshold > 1.00 V or for signal range check • > 15 - 115.87 V	• Engine speed, > 1000 RPM or for signal range check • ECT > 40.5° C • Engine load > 35 - 60% • Engine speed > 2000 RPM	0.5 Sec.	• 2 DCY
P0340	Camshaft Position Sensor Circuit	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .	Cam adaptation values out of range • > 20 °KW • < -20 °KW • Difference of adapted and actual values > 9 °KW	• Engine speed sensor, No DTC • Phase sensor, No DTC • Cam adaptation, Active • Engine speed sensor, No DTC • Phase sensor, No DTC • Camshaft adjustment, No DTC • Engine start, Completed • Cam adaptation, Completed • Camshaft in ref pos. for > 2 sec.	2 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0341	Camshaft Position Sensor Circuit Performance	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .	• Signal pattern incorrect • Defect counter 12		0.5 Sec.	• 2 DCY
P0342	Camshaft Position Sensor Circuit Low	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .	• Signal voltage low • Crankshaft signals = 8		0.5 Sec.	• 2 DCY
P0343	Camshaft Position Sensor Circuit High	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .	• Signal voltage high • Crankshaft signals = 8		0.5 Sec.	• 2 DCY
P0351	Ignition Coil A Primary Circuit	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0352	Ignition Coil B Primary Circuit	– Check the Ignition Coil with Power Output Stage -N127-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY
P0353	Ignition Coil C Primary Circuit	– Check the Ignition Coil with Power Output Stage -N291-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY
P0354	Ignition Coil D Primary Circuit	– Check the Ignition Coil with Power Output Stage -N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY
P0410	Secondary Air Injection System	– Check the Secondary Air Injection Pump Motor -V101-. Refer to ⇒ S3.6.27 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 577 .	• deviation SAI pressure sensor > 5.0 kPa	• Mass air flow 7 - 140 kg/h • Delta engine load -7 to 7% • ECT 5.3 - 50.3 °C • IAT 5.3 - 60 °C • Altitude < 2700 m • SAI press sensor ready, no fault	0.5 Sec.	• Once/DCY • 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0413	Secondary Air Injection System Switching Valve Circuit Open	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .	• Signal voltage 4.70 - 5.40 V	• Air valve commanded off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0414	Secondary Air Injection System Switching Valve Circuit Low	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .	• Signal voltage 0 to 3.25 V or • Signal current > 2.20 A	• Air valve commanded off • Engine speed > 80 RPM or • Air valve commanded on • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0418	Secondary Air Injection System Control Circuit	– Check the Secondary Air Injection Pump -V101-. Refer to ⇒ S3.6.27 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 577 .	• Signal voltage 4.70 - 5.40 V	• Pump relay commanded off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0420	Catalyst System Efficiency Below Threshold	– Check the Three Way Catalytic Converter (TWC). Refer to ⇒ W3.6.30 ay Catalytic Converter (TWC), Checking", page 584 . – Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .	Front: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 1.00 • Front catalyst < 1.50 • Main catalyst < 1.00 Main: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 0.40 • Front catalyst< .90 • while value for front catalyst < 2.00	Front: • Time after engine start > 0 Sec. • Delta exhaust mass flow < 23.1 kg/h • Exhaust gas mass flow, lower range 40.0 - 130.0 kg/h • Exhaust gas mass flow upper range 60.0 - 130.0 kg/h • Modeled exhaust gas temp, lower range > 460 °C • Modeled exhaust gas temp, upper range 640 - 780 °C • Engine speed 1320 — 3520 RPM • Number of checks, 4 • O2S front/rear, ready/no faults • SAS, not active • No misfire Main: • Time after engine start > 80 Sec. • Delta exhaust mass flow < 30 kg/h • Exhaust gas mass flow, lower range 25.0 - 80.0 kg/h • Exhaust gas mass flow upper range 60.0 - 160.0 kg/h • Modeled exhaust gas temp, lower range 435 - 660 °C • Modeled exhaust gas temp, upper range 530 - 740 °C	15 to 40 Sec.	• Once/DCY • 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
				• Engine speed 1200 — 3520 RPM • Number of checks, 4 • O2S front/rear, ready/no faults • SAS, not active • No misfire		
P043E	Evaporative Emission System Leak Detection Reference Orifice Low Flow	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• EVAP pump current during reference measurement engine off > 40 mA	• ECT @ start >= 4° C • difference between ECT and IAT @ start <= 15K • engine off time >= 5 sec • airbag not activated	10 Sec	2 DCY
			• EVAP pump current during reference measurement engine on < 40 mA	• ECT @ start < 60° C • AAT < 35° C • time since last engine start>= 600 sec • intake manifold vacuum > 30 kPa • delta vehicle speed < 16 mph • RPM > 20 rpm • front OS2 ready	2.5 Sec	2 DCY
P043F	Evaporative Emission System Leak Detection Reference Orifice High Flow	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• EVAP pump current during reference measurement engine off > 15mA	• ECT @ start >= 4° C • difference between ECT and IAT @ start <= 15K • engine off time >= 5 sec • airbag not activated	10 Sec	2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
			• EVAP pump current during reference measurement engine on > 15mA	• ECT @ start < 60° C • AAT < 35° C • time since last engine start>= 600 sec • intake manifold vacuum > 30 kPa • delta vehicle speed < 16 mph • RPM > 20 rpm • front OS2 ready	2.5 Sec	2 DCY
P0441	Evaporative Emission System Incorrect Purge Flow	– Check the EVAP System, for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 - N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 . – Check the Leak Detection Pump - V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• Deviation < 8% lambda controller and 35% idle controller	• Evap purge flow integral 25 - 120 g • Integrated air mass 1.50 - 2.50 kg • Engine speed = idle • Engine speed deviation < 80 RPM • ECT > 65 °C or substitute 80 °C • IAT > 4 °C • Altitude < 2700 m • Lambda control, closed loop	120 Sec.	• Once/DCY • 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0442	Evaporative Emission System Leak Detected Small Leak	– Check the EVAP System, for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 . – Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	Time for pressure drop < 1.6 - 1.8 Sec.	• Time after engine start 12 - 65530 Sec. • ECT 3.8 - 120 °C • ECT at start 5 - 50 °C • Engine off time > 21600 Sec. • Ambient air temp 5 - 59 °C • Ambient air temp drop after start < 8 °K • Intake manifold vac. > -2560 hPa • Altitude < 2700 m • Veh. speed >= 0 • Veh speed once > 40 km/h • Any drive gear • Restart temp diff. > 0 °K • Purge valve closed • LDP active	139 Sec. once/DCY	• 2 DCY
P0444	Evaporative Emission System Purge Control Valve Circuit Open	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .	Signal voltage > 4.70 - 5.40 V	• EVAP purge valve Commanded Off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0447	Evaporative Emission System Vent Control Circuit Open	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	Signal voltage > 4.70 - 5.40 V	• EVAP purge valve Commanded Off	0.5 Sec	• 2 DCY
P0448	Evaporative Emission System Vent Control Circuit Shorted to B+ or ground	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• Short to B+ - Signal current > 2.2 - 4.0 A • Short to Ground - Signal voltage < 2.74 - 3.26 V	• Short to B+ - EVAP pump solenoid valve commanded ON • Short to ground - EVAP pump commanded Off	0.5 Sec	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0455	Evaporative Emission System Leak Detected Gross Leak/No Flow	– Check the EVAP System, for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 . – Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	Time for pressure drop < 1 Sec.	• Time after engine start 12 - 65530 Sec. • ECT 5 - 120 °C • ECT at start 5 - 50 °C • Engine off time > 21600 Sec. • Ambient air temp 5 - 59 °C • Ambient air temp drop after start < 12 °K • Intake manifold vac. > -2560 hPa • Altitude < 2700 m • Veh. speed >= 0 • Veh speed once > 40 km/h • Any drive gear • Restart temp diff. > 0 °K • Purge valve closed • LDP active	136 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0456	Evaporative Emission System Leak Detected Very Small Leak	– Check the EVAP System, for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 - N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 . – Check the Leak Detection Pump - V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• Time for pressure drop, < 4.5 - 6.0 Sec.	• Time after engine start 12 - 1000 Sec. • ECT 3.8 - 120 °C • ECT at start 3.8 - 50.3 °C • Engine off time > 21600 Sec. • Ambient air temp 3.8 - 59.3 °C • Ambient air temp drop after start < 4.5 °K • Intake manifold vac. > -2560 hPa • Intake manifold vac. > -2560 hPa • Altitude < 2700 m • Veh. speed >= 0 • Veh speed once > 40 km/h • Any drive gear • Restart temp diff. > 0 K • Purge valve closed • LDP active	180 Sec. once/DCY	• 2 DCY
P0458	Evaporative Emission System Purge Control Valve Circuit Low	– Check the EVAP Canister Purge Regulator Valve 1 - N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .	Signal voltage 0 - 3.26 V	• EVAP purge valve, Commanded off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0459	Evaporative Emission System Purge Control Valve Circuit High	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .	Signal current > 2.2 A	• EVAP purge valve, Commanded On • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0491	Secondary Air System Insufficient Flow	– Check the Secondary Air System. Refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .	SAI pressure sensor vs modeled pressure < 60 to 75%	• Mass airflow 7 - 140 kg/h • Delta engine load -7 to 7% • ECT 5.3 - 50.3 °C • IAT 5.3 - 60 °C • Altitude <2700 • SAI press sensor, ready - no fault	43.5 Sec.	• 2 DCY
P050A	Cold Start Idle Air Control System Performance	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	Out of range low: • Engine speed deviation < -80 RPM Out of range high: • Engine speed deviation > 80 RPM	Out of range low: • Time after engine start > 0 Sec. • Engine speed, idle • Veh speed 0 km/h • Altitude < 2700 m • IAT > -48.0 °C • Catalyst heating active • ECT < 143 °C • Lambda control active • EVAP purge adaptation < 22 • External torque request active	3 - 5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P050B	Cold Start Ignition Timing Performance	Check for any Engine Speed sensor or Ignition Coil faults and diagnose them first. If NO other codes are set, replace the ECM. – Engine Control Module (ECM) -J623-. Refer to the Repair Manual.	Difference between commanded spark timing vs. actual value > 20%	• Time during catalyst heating > 12 Sec. • Commanded spark retard during catalyst heating < 100% • Idle speed not active • Vehicle speed >= 5 km/h • Delta engine load <= 10.01% • Delta engine speed <= 100 RPM	10 Sec.	• Once/DCY • 2 DCY
P0501	Vehicle Speed Sensor Range/ Performance	– Check vehicle speed signal. Refer to ⇒ S3.6.33 peed Signal, Checking", page 589 .	VSS signal < 6 km/h	• Engine torque > 120 Nm • Engine speed > 2800 RPM	2000 ms.	• 2 DCY
P0503	Vehicle Speed Sensor Intermittent/ Erratic/High	– Check vehicle speed signal. Refer to ⇒ S3.6.33 peed Signal, Checking", page 589 .	Vehicle speed > 290 km/h		0.5 Sec.	• 2 DCY
P0506	Idle Air Control System RPM Lower Than Expected	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	Integrated engine speed deviation > 2000 RPM OR engine speed deviation > 80 RPM	• Engine speed, idle • Vehicle speed 0 MPH • Altitude < 2700 m • IAT, > -48 °C • ECT, > -48 °C • Time after engine start > 0 Sec. • Lambda control active	3 to 5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0507	Idle Air Control System RPM Higher Than Expected	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	Idle speed Deviation < -80 RPM	• Engine speed, idle • Vehicle speed 0 MPH • Altitude < 2700 m • IAT, > -48 °C • ECT, > -48 °C • Time after engine start > 0 Sec. • Lambda control active	6 Sec.	• 2 DCY
P052 A	Cold Start Camshaft Position Timing Over-Advanced	Make sure correct viscosity oil is used. – Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .	Difference between target and actual position > 6 CRK °	• Time after engine start >= 15 Sec. • Engine speed >= 0 RPM • Modeled oil temperature >= -13 °C • Catalyst heating active	5 Sec.	• 2 DCY
P053 F	Cold Start Fuel Pressure Performance	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .	• Difference between target pressure vs actual pressure: > 1.50 MPa • OR • < -1.50 MPa	• Time after engine start 3 Sec. • Fuel cutoff not active • Catalyst heating active	3 Sec.	• 2 DCY
P0606	ECM Processor Fault	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.	ECM internal check failure or BARO failure (located in the ECM).	Key on or engine running	• 2 Sec.	• 2 DCY • Continuous
P062 B	Internal Control Module Fuel Injector Control Performance	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.	Internal logic failure	Engine speed > 80 RPM	2.2 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0634	ECM Internal Temperature Too High	If an injector circuit code exists, perform diagnosis for that code first as a short will set this fault. – Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.	Power stage temperature > 150 °C	Engine speed > 80 RPM	0.5 Sec.	• Continuous • 2 DCY
P0638	Throttle Actuator Control Range/ Performance	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	• Time to close to reference point > 0.6 Sec. and • reference point 2.88% • TPS 1 signal 0.40 - 0.60 V • TPS 2 signal 4.20 - 4.60 V • TPS 1 and TPS 2 4.82 - 5.18 V	• Engine speed 0 RPM • Vehicle speed 0 km/h • ECT > 5.3 to 114.8 °C • IAT > 5.3 to 143.8 °C • Engine shutoff time 5 Sec. • Number of checks = 2	0.3 to 5 Sec.	• 2 DCY
P0641	Sensor Reference Voltage A Circuit Open	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module (ECM) -J623-. Refer to the Repair Manual.	Signal voltage deviation > +/- 0.3 V		0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0651	Sensor Reference Voltage B Circuit Open	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module (ECM) -J623-. Refer to the Repair Manual.	Signal voltage deviation > +/- 0.3 V		0.5 Sec.	• 2 DCY
P0657	Actuator Supply Voltage Circuit Open	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking", page 565 .	Signal voltage, > 4.4 - 5.6 V	• Relay, commanded off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0658	Actuator Supply Voltage Circuit Low	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking", page 565 .	Signal voltage, < 2.15 - 3.25 V	• Relay, commanded off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0659	Actuator Supply Voltage Circuit High	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking", page 565 .	Signal current > 1.1 A	• Relay, commanded on • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0697	Sensor Reference Voltage Circuit Open	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module (ECM) -J623-. Refer to the Repair Manual.	Signal voltage deviation > +/- 0.3 V		0.5 Sec.	• 2 DCY
P117A	Bank 1 Sensor 2 Control Limit Reached	– Check the- Oxygen Sensor 1 After Catalytic Converter -GX7- in center of the catalytic converter . Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569	I portion of 3rd lambda control loop > 0.030	• Engine speed 1200 to 4000 RPM • Modeled exhaust gas temp 350 to 1000 °C • Engine load 21.8 to 99.8% • 1st, 2nd, 3rd lambda control in closed loop • O2S rear and heater ready, no faults	1800 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .	• Pressure control activity > 0.20 MPa • Fuel trim activity < 0.80 • Difference between actual pressure vs target pressure -16.38 to 16.38 MPa	• Engine speed > 600 RPM • EVAP purge adaptation < 22.0 • ECT >= 63 °C • IAT < 90 °C • Lambda control closed loop • Fuel cutoff not active	5 Sec.	• 2 DCY
P12A2	Fuel Rail Pressure Sensor Inappropriately High	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .	• Pressure control activity < -0.05 MPa • Fuel trim activity > 1.65 • Difference between target pressure and actual pressure -16.38 to 16.38 MPa	• Engine speed > 600 RPM • EVAP purge adaptation < 22.0 • ECT >= 63 °C • IAT < 90 °C • Lambda control closed loop • Fuel cutoff not active	5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P12A4	Fuel Rail Pump Control Valve Stuck Closed	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .	• Fuel trim activity .90 to 1.15 • Pressure control activity < -6 MPa • System Deviation < 16.38 MPa	• Engine speed > 600 RPM • EVAP purge adaptation < 22.0 • ECT >= 63 °C • IAT < 90 °C • Lambda control closed loop • Fuel cutoff not active	5 Sec.	• 2 DCY
P13EA	Cold Start Ignition Timing Performance Off Idle	Check for any Engine Speed sensor or Ignition Coil faults and diagnose them first. If NO other codes are set, replace the ECM. – Engine Control Module -J623-. Refer to the appropriate repair manual.	Difference between commanded spark timing vs. actual value > 40%	• Time during catalyst heating > 12 Sec. • Commanded spark retard during catalyst heating < 100% • Idle speed not active • Vehicle speed >= 5 km/h • Delta engine load <= 10.01% • Delta engine speed <= 100 RPM	10 Sec.	• Once/DCY • 2 DCY
P150A	Engine Off Timer Performance	– If ignition off B+ is lost to ECM, this code will set. Check power and ground inputs to ECM first. Refer to Wiring Diagrams for pin locations. If all power/grounds to ECM are present, replace the Engine Control Module (ECM) -J623-. Refer to the Repair Manual.	Difference between engine off time and ECM after run time < -12 Sec. or > 12 Sec.	• Key on after ECM after run time active • Key on during ECM after run time active • CAN active	6.0 Sec.	• 2 DCY
P1609	Crash Shut Down Was Deployed	Erase ECM code after proper repair of damage.	Airbag was activated		0 Sec.	• Continuous • 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P169A	Vehicle in Transport Mode	Perform readiness check.	Transport mode active		0	• 1DCY
P2008	Intake Manifold Runner Control Circuit Open	– Check the Intake Manifold Runner Control Valve -N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .	• Signal voltage 4.70 - 5.40 V	• Tumble flap commanded off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P2009	Intake Manifold Runner Control Circuit Low	– Check the Intake Manifold Runner Control Valve -N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .	• Signal voltage 0 to 3.26 V	• Tumble flap commanded off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P2010	Intake Manifold Runner Control Circuit High	– Check the Intake Manifold Runner Control Valve -N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .	• Signal current > 2.20 A	• Tumble flap commanded on • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P2014	Intake Manifold Runner Position Sensor Circuit	– Check the Intake Manifold Runner Position Sensor -G336-. Refer to ⇒ I3.6.18 ntake Manifold Runner Position SensorG336, Checking", page 557 .	Signal voltage > 4.75 V		0.3 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2015	Intake Manifold Runner Position Sensor Circuit Range/ Performance	– Check the Intake Manifold Runner Position Sensor -G336-. Refer to ⇒ I3.6.18 ntake Manifold Runner Position SensorG336, Checking", page 557 .	• Deviation runner flap target position vs actual position > 25% • Actual position 0 to 100%	• Flap commanded on or off • Adaptation ready	1.5 Sec.	• 2 DCY
P2016	Intake Manifold Runner Position Sensor Circuit Low	– Check the Intake Manifold Runner Position Sensor -G336-. Refer to ⇒ I3.6.18 ntake Manifold Runner Position SensorG336, Checking", page 557 .	Signal voltage < 0.25 V		0.3 Sec.	• 2 DCY
P2088	A Camshaft Position Actuator Control Circuit Low	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .	Signal voltage 0 - 3.25 V	• Camshaft valve off • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P2089	A Camshaft Position Actuator Control Circuit High	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .	Signal current > 2.2 A	• Camshaft valve on • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2096	Post Catalyst Fuel Trim System Too Lean	Check exhaust system for leaks first and correct as necessary. – Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking”, page 569 .	Deviation lambda control < -0.03	• Modeled exhaust gas temp 450 to 850 °C • Exhaust gas mass flow 14 to 300 kg/h • Lambda control in closed loop, not at min or max limit • O2S front ready, no DTC • O2S rear ready, no DTC • O2 heaters active • Not in fuel cutoff, SAI off • Catalyst heating not active	45 Sec.	• 2 DCY
P2097	Post Catalyst Fuel Trim System Too Rich	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking”, page 569	Integral part of lambda control > 0.03%	• Modeled exhaust gas temp 450 to 850 °C • Exhaust gas mass flow 14 to 300 kg/h • Lambda control in closed loop, not at min or max limit • O2S front ready, no DTC • O2S rear ready, no DTC • O2 heaters active • Not in fuel cutoff, SAI off • Catalyst heating not active	45 Sec.	• 2 DCY
P2101	Throttle Actuator Control Motor Circuit Range/ Performance	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking”, page 585 .	• Duty cycle > 80% • Deviation throttle value angles vs. calculated value 4 - 50% • ECM power stage no failure		0.5 - 5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2106	Throttle Actuator Control System - Forced Limited Power	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .	Internal check failed	Duty cycle > 80% or deviation throttle value angles vs. calculated value > 4 - 50%	0.5 - 5 Sec.	• 2 DCY
P2122	APP Sensor 1/APP Sensor 2 Circuit D Low Input	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .	Signal voltage < 0.61 V		0.5 Sec.	• 2 DCY
P2123	APP Sensor 1/APP Sensor 2 Circuit D High Input	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .	Signal voltage > 4.79 V		0.5 Sec.	• 2 DCY
P2127	APP Sensor 1/APP Sensor 2 Circuit E Low Input	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .	Signal voltage < 0.27 V		0.5 Sec.	• 2 DCY
P2128	APP Sensor 1/APP Sensor 2 Circuit E High Input	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .	Signal voltage > 2.43 V		0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2138	APP Sensor 1/APP Sensor 2 Circuit D/E Voltage Correlation	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .	• Signal voltage: Difference between signal APP1 and APP2 > 0.17 - 0.70 V	• Signal voltage sensor 1 > 445.0 mv • Signal voltage sensor 2 > 445.0 mv	0.24 Sec.	• 2 DCY
P2146	Fuel Injector Group A Supply Voltage Circuit Open	– Check the Fuel Injectors -N30, N31, N32, N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	• Signal current, < 2.6 A or • Signal current > 14.90 A	• Engine speed > 80 RPM or • Low side signal current > 2.70 A	0.5 Sec.	• 2 DCY
P2149	Fuel Injector Group B Supply Voltage Circuit Open	– Check the Fuel Injectors -N30, N31, N32, N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .	• Signal current, < 2.6 A or • Signal current > 14.90 A	• Engine speed > 80 RPM or • Low side signal current > 2.70 A	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2177	System Too Lean Off Idle	– Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking”, page 572 . – Check the intake system for leaks (false air) . – Check the vacuum lines for leaks	Adaptive value > 28%	• Engine speed 1280 to 6000 RPM • Engine load 20 to 100% • Mass air flow 30 to 300 kg/h • ECT > 63 °C • IAT < 90 °C • Lambda control closed loop • Evap purge valve closed	10 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2178	System Too Rich Off Idle	– Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking”, page 572 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking”, page 542 .	Adaptive value < -21%	• Engine speed 1280 to 6000 RPM • Engine load 20 to 100% • Mass air flow 30 to 300 kg/h • ECT > 63 °C • IAT < 90 °C • Lambda control closed loop • Evap purge valve closed	10 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2181	Cooling System Performance	– Check Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 . – Check the Coolant Pump -V50- Refer to the Repair Manual. – Check the Coolant Thermostat. Refer to the Repair Manual.	Cooling system temperature too low after a sufficient mass air flow integral 74 - 84 °C	• Begin of air mass integration when engine temp > 30 °C • ECT at start, - 7 - 64 °C • Ambient air temp -7 °C • Fuel cutoff not active and engine load 0 - 400% • Delta ambient pressure < 1.5 kPa • Integrated air mass depending on engine temp at start and ambient air temperature 4 - 23 kg/h • Accumulated fuel cutoff < 40 - 250 Sec. At time of fault decision • Average mass air flow 20 - 154 kg/h • Average veh. speed 33.4 - 120 km/h	2 Sec.	• 2 DCY
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 .	ECT outlet > 141 °C		2 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2185	Engine Coolant Temperature Sensor 2 Circuit High	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 .	ECT outlet < -43 °C		2 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2187	System Too Lean At Idle	– Check the intake system for leaks (air not metered through the MAF) . – Check the vacuum lines for leaks – Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	Adaptive value > 5.02%	• Engine speed 520 to 1200 RPM • Engine load < 17 to 45% • Mass air flow 5 to 26 kg/h • ECT > 63 °C • IAT < 90 °C • Delta part load adaptation ready • Lambda closed loop • EVAP purge valve closed	10 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2188	System Too Rich At Idle	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .	Adaptive value < -5.02%	• Engine speed 520 to 1200 RPM • Engine load < 17 to 45% • Mass air flow 5 to 26 kg/h • ECT > 63 °C • IAT < 90 °C • Delta part load adaptation ready • Lambda closed loop • EVAP purge valve closed	10 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2195	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572	• Delta lambda of 2nd lambda control loop > 0.08	• Modeled exhaust gas temp 450 - 850 °C • Delta engine load < 35% • Exh. gas mass flow 14 - 300 kg/h • Lambda control, 2nd lambda control, closed loop • O2S front, rear and heaters ready - no fault • Fuel cutoff, catalyst heating, SAI - not active • 1st lambda control loop not at min or max • 2nd lambda control loop active	95 Sec.	• 2 DCY
P2196	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572	• Delta lambda of 2nd lambda control loop < -0.08	• Modeled exhaust gas temp 450 - 850 °C • Delta engine load < 35% • Exh. gas mass flow 14 - 300 kg/h • Lambda control, 2nd lambda control, closed loop • O2S front, rear and heaters ready - no fault • Fuel cutoff, catalyst heating, SAI - not active • 1st lambda control loop not at min or max • 2nd lambda control loop active	95 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2231	O2 Sensor Bank 1 Sensor 1 Signal Circuit Shorted to Heater Circuit	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572	Delta O2S signal front > 190 uA	• Engine speed, < 2700 RPM • Engine load < 60% • Heater duty cycle, 20 - 80% • Modeled exhaust gas temp < 800.1 °C • lambda 0.95 - 1.05 • Heater control, closed loop, no fault	15 Sec.	• 2 DCY
P2237	O2 Sensor Positive Current Control Circuit Open Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	• O2S signal front 1.49 - 1.51 V • Delta lambda controller > 0.10	• O2S ceramic temp, 715 °C • Lambda control, Closed loop • Modeled exhaust gas temp > 700 °C • Lambda modulation > 0.02 • Heater control closed loop	5 to 8 Sec.	• 2 DCY
P2243	O2 Sensor Reference Voltage Circuit Open Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572	• O2S signal front > 3.25 V and Internal resistance > 1000 Ohm • O2S signal front < 0.30 V and Internal resistance > 1000 Ohm	• Heater control active	20 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2251	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572	O2S signal front 1.47 to 1.53 V and internal resistance > 1000 Ohm	• Modeled exhaust gas temp < 700 °C • No fuel cutoff > 2 Sec. • Heater control active	25 Sec.	• 2 DCY
P2257	Secondary Air Injection System Control Circuit Low	– Check the Secondary Air Injection Pump -V101-. Refer to ⇒ S3.6.27 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 577 .	• Signal voltage 0 to 3.26 V	• Pump relay commanded off • Engine speed > 80 mph	0.5 Sec.	• 2 DCY
P2258	Secondary Air Injection System Control Circuit High	– Check the Secondary Air Injection Pump -V101-. Refer to ⇒ S3.6.27 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 577 .	• Signal current .60 - 2.40 A	• Pump relay commanded on • Engine speed > 80 mph	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2270	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569	• Sensor voltage of <= 0.75 V • O2S signal rear < -2.00 mV • Enrichment after stuck lean 27.9%	• Mass air flow 25 to 150 kg/h • Modeled exhaust gas temp > 350 °C • O2 readiness > 30 Sec. • 2nd lambda control closed loop	95 Sec.	• 2 DCY
P2271	O2 Sensor Signal Stuck Rich Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569	• Sensor voltage of >= 0.15 V • After oxygen mass flow > 3000 mg • Number of checks >= 1	• Time of fuel cutoff <= 90 Sec. • Time after last fuel cutoff >= 20 Sec. • O2 rear ready • Exhaust temp at sensor >= 385 °C • Exhaust mass flow > 12 kg/h • Exhaust mass flow dynamic within range -80 to 80 kg/h	10 Sec.	• 2 DCY
P2274	O2 Sensor Signal Stuck Lean Bank 1 Sensor 3	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569	• Sensor voltage of <= 0.70 V • O2S rear signal not oscillating at reference < 0.62 to 0.65 V • Enrichment after stuck lean 27.9%	• Mass air flow 25 to 150 kg/h • O2S rear readiness > 30 Sec. • Modeled exhaust gas temp > 350 °C • 2nd lambda control closed loop	215 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2275	O2 Sensor Signal Stuck Rich Bank 1 Sensor 3	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569	• O2S sensor voltage >= 0.15 V • After oxygen mass flow (fuel cutoff) > 4500 mg • Number of checks >= 1	• Time of fuel cut-off <= 90 Sec. • Time after last fuel cutoff >= 20 Sec. • O2S rear ready • Exhaust temp at sensor >= 385 °C • Exhaust mass flow > 12 kg/h • Exhaust mass flow dynamic within range -80 to 80 kg/h • Sensor voltage at start of measurement > 0.45 V	10 Sec.	• 2 DCY
P2279	Intake Air System Leak	Check for air leaks between MAF and throttle body, oil fill cap not tight or oil dipstick not seated in tube. Also any engine gaskets that can cause additional air to enter the crankcase can set this fault as the PCV system is not metered. If a vacuum leak or crankcase gasket sealing is at cause, the idle may be rough or unstable.	• Threshold to detect a defective system > 1.33 - 1.60	• Time after engine start > 60 Sec. • Engine load < 40% • Mass air flow < 6553.50 kg/h • ECT > 49.50 °C • IAT < 99.80 °C • Lambda control value > .95 • Lambda set value .95 - 1.05 • Veh speed < 1 km/h • Lambda control active • Engine speed - idle • Altitude < 2700 m • O2S front - no fault	23 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2293	Fuel Pressure Regulator 2 Performance	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .	• Difference between target pressure vs actual pressure: > 1.50 MPa • OR • < -1.50 MPa	• Time after engine start 10 Sec. • Fuel cutoff not active	3.0 Sec.	• 2 DCY
P2294	Fuel Pressure Regulator 2 Control Circuit	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .	• Signal voltage 1.40 - 3.20 V • OR • Signal pattern incorrect	• Fuel control valve, Commanded Off • Fuel pump, Commanded On	0.5 Sec.	• 2 DCY
P2295	Fuel Pressure Regulator 2 Control Circuit Low	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .	Signal voltage 1.40 - 3.20 V	• Fuel control valve, Commanded Off	0.5 Sec.	• 2 DCY
P2296	Fuel Pressure Regulator 2 Control Circuit High	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .	Signal voltage > 3.20 V	• Fuel control valve, Commanded On	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2300	Ignition Coil A Primary Control Circuit Low	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	Signal current > 24.0 mA	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY
P2301	Ignition Coil A Primary Control Circuit High	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	Signal voltage > 5.1 - 7.0 V	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY
P2303	Ignition Coil B Primary Control Circuit Low	– Check the Ignition Coil with Power Output Stage -N127-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	Signal current > 24.0 mA	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY
P2304	Ignition Coil B Primary Control Circuit High	– Check the Ignition Coil with Power Output Stage -N127-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	Signal voltage > 5.1 - 7.0 V	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2306	Ignition Coil C Primary Control Circuit Low	– Check the Ignition Coil with Power Output Stage -N291-. Refer to ⇒ Ì3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	Signal current > 24.0 mA	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY
P2307	Ignition Coil C Primary Control Circuit High	– Check the Ignition Coil with Power Output Stage -N291-. Refer to ⇒ Ì3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	Signal voltage > 5.1 - 7.0 V	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY
P2309	Ignition Coil D Primary Control Circuit Low	– Check the Ignition Coil with Power Output Stage -N292-. Refer to ⇒ Ì3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	Signal current > 24.0 mA	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY
P2310	Ignition Coil D Primary Control Circuit High	– Check the Ignition Coil with Power Output Stage -N292-. Refer to ⇒ Ì3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .	Signal voltage > 5.1 - 7.0 V	• Engine speed > 680 RPM	2 Sec.	• Continuous • 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P240 A		– Check the Leak Detection Pump - V144-. Refer to ⇒ "3.6.21 Leak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• Signal voltage > 4.70 - 5.40 V	• EVAP pump heater commanded Off	0.5 Sec	• 2 DCY
P240 B		– Check the Leak Detection Pump - V144-. Refer to ⇒ "3.6.21 Leak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• Signal voltage < 2.74 - 3.26 V	• EVAP pump heater commanded Off	0.5 Sec	• 2 DCY
P240 C		– Check the Leak Detection Pump - V144-. Refer to ⇒ "3.6.21 Leak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• Signal current > 2.2 - 4.0 A	• EVAP pump heater commanded ON	0.5 Sec	• 2 DCY
P2400	Evaporative Emission System Leak Detection Pump Control Circuit Open	– Check the Leak Detection Pump - V144-. Refer to ⇒ "3.6.21 Leak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	Signal voltage > 4.4 - 5.6 V	• LDP Commanded off • Engine speed, 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	Signal voltage > 2.15 - 3.25 V	• LDP Commanded Off • Engine speed, 80 RPM	0.5 Sec.	• 2 DCY
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	Signal current > 3 A	• LDP Commanded On • Engine speed, 80 RPM	0.5 Sec.	• 2 DCY
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit Open	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	Low signal voltage > 0.5 Sec.	• Time after engine start 5.0 - 65530 • ECT 5 - 120 °C • ECT at start 5 - 50 °C • Engine off time > 21600 • Altitude < 2700 m • Integrated purge flow > 12 g • Restart temp diff > 0 °K • Veh speed >= 0 km/h • Veh speed ones > 30 km/h • Any drive gear • EVAP purge valve ready, no faults • LDP commanded off	0.5 Sec.	• Once/DCY • 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2404	Evaporative Emission System Leak Detection Pump Sense Range/ Performance	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• High signal voltage > 12 Sec. • Number of checks = 30	• Time after engine start 12 - 65530 • Engine off time > 21600 • ECT 5 - 120 °C • ECT at start 5 - 50 °C • Ambient air temp 5 - 59 °C • Altitude < 2700 m • Intake manifold vacuum > -2560 hPa • Restart temp diff > 0 °K • Veh speed >= 0 km/h • Veh speed ones > 30 km/h • Any drive gear • EVAP purge valve ready, no faults • LDP commanded off	12 to 143 Sec.	• Once/DCY • 2 DCY
P2407	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/ Erratic	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• Fluctuation of EVAP pump current during reference measurement engine off > 2mA • Or drop of EVAP pump current during pump phase of 3 sec > 6mA	• ECT @ start >= 4° C • difference between ECT and IAT @ start <= 15K • engine off time >= 5 sec • airbag not activated	800 Sec	2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
			• Fluctuation of EVAP pump current during reference measurement engine on > 2mA • Or drop of EVAP pump current during pump phase of 3 sec > 6mA	• ECT @ start < 60° C • AAT < 35° C • time since last engine start>= 600 sec • intake manifold vacuum > 30 kPa • delta vehicle speed < 16 mph • RPM > 20 rpm • front OS2 ready	19 Sec	2 DCY
P2414	O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	Threshold 1 • Signal voltage 3.1 - 4.81 V Threshold 2 • O2S signal 2.5 - 3.2 V	• Lambda set value < 1.6 • Fuel cut off, Not active • Heater control, closed loop • SAI not active • O2S ceramic temp > 720 °C • If low fuel signal then wait > 0 Sec.	15 Sec.	• 2 DCY
P2431	Secondary Air Injection Sensor Performance	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .	• Difference between SAI pressure sensor and ambient pressure NOT -60.0 to 60.0 hPa	SAI completed	0.5 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2432	Secondary Air Injection Sensor Circuit Low	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .	• Signal voltage < 0.40 V		0.5 Sec.	• Continuous • 2 DCY
P2433	Secondary Air Injection Sensor Circuit High	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .	• Signal voltage > 4.65 V		0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2440	Secondary Air Injection System Switching Valve Stuck Open	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .	• SAI pressure sensor vs modeled while SAI valve is closed < 71.1%	• ECT 5.3 - 50.3 °C • IAT 5.3 - 60 °C • Altitude < 2700 m • SAI press sensor ready, no fault	43.5 Sec.	• 2 DCY
P2450	Evaporative Emission System Switching Valve Performance/ Stuck Open	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .	• Engine off EVAP pump current difference between reference measurement to idle < 3mA	• ECT @ start >= 4° C • difference between ECT and IAT @ start <= 15K • engine off time >= 5 sec • airbag not activated	13.5 Sec	2 DCY
			• Engine on EVAP pump current difference between reference measurement to idle >3mA	• ECT @ start < 60° C • AAT < 35° C • time since last engine start>= 600 sec • intake manifold vacuum > 30 kPa • delta vehicle speed < 16 mph • RPM > 20 rpm • front OS2 ready	4 Sec	2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2626	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .	• O2S signal front > 4.81 V	• Modeled exhaust temp < 700 °C • O2S ceramic temp > 715 °C • Fuel cut off, Active • Heater control closed loop • No low fuel signal	1.5 Sec.	• 2 DCY
P3081	Engine Temperature Too Low	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 . – Check the engine coolant thermostat. Refer to the Repair Manual.	Cooling system temperature < 74°C - 84° C after AAT check		4 Sec.	• 2 DCY
U000 1	High Speed CAN Communication Bus	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .	CAN message, no feedback	Time after ignition on, 500 ms.	250 ms.	• 2 DCY
U000 2	High Speed CAN Communication Bus Performance	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .	Global Time Out failure	Time after ignition on, 500 ms.	450 ms.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
U0101	Lost Communication with TCM	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .	• Time Out failure. No message received by ECM	Time after ignition on, 500 ms.	500 ms.	• 2 DCY
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .	CAN communication with ABS Time Out - no message	Time after ignition on, 500 ms.	500 ms.	• 2 DCY
U0146	Lost Communication With Gateway A	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .	CAN communication with gateway Time Out - no message	Time after ignition on, 500 ms.	500 ms.	• 2 DCY
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .	No CAN messages received	Time after ignition on, 500 ms.	2000 ms.	• 2 DCY
U0302	Software Incompatibility with Transmission Control Module	– Check for software updates and TSB's. Reprogram as necessary. If none are found, replace the Direct Shift Gearbox (DSG) Mechatronic -J743-. Refer to the Repair Manual.	AT vehicle ECM coded as MT vehicle	Time after ignition on, 500 ms.	5000 ms.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
U040 2	Invalid Data Received From Gear Shift Control Module A	– Check for software updates and TSB's. Reprogram as necessary. If none are found, replace the Direct Shift Gearbox (DSG) Mechatronic -J743-. Refer to the Repair Manual.	Transmission Data implausible message	Time after ignition on, 500 ms.	60 ms.	• 2 DCY
U041 5	CAN Communication With ABS Error	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .	• Speed sensor initialization failed • Speed sensor low voltage error failed • Implausible message received	Time after ignition on, 500 ms.	50 to 2100 ms.	• 2 DCY
U042 2	Invalid Data Received From Body Control Module (IPC)	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 If no fault is found, replace the Instrument Panel Cluster (IPC). Refer to the Repair Manual.	Ambient temperature value initialization failure.	• Status ambient temperature from instrument cluster no fault • Electrical check ambient temperature sensor no fault	2.0 Sec.	• 2 DCY
U042 3	Invalid Data Received From Instrument Panel Cluster Control Module	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568	Implausible CAN message received OR ambient temperature value = 00	Time after ignition on, 500 ms.	3 Sec.	• 2 DCY

DTC	Error Message	Component Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
U0447	Lost Communication With Gateway	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .	CAN message implausible	Time after ignition on, 500 ms.	300 ms.	• 2 DCY

3.4.2 Engine Control Module, 2015 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P000A "A" Camshaft Position Slow Response Bank 1	VVT Actuator Intake Rationality Check	• Adjustment angle difference >= 3.00 < 15.00° CRK	• Modeled oil temperature -40 to 160° C • Engine speed 608 to 6,016 RPM • Set point change > 29.00° CRK • Camshaft position n.a. • Dynamic diagnosis timer >= 0.95 to 4.00 sec.	• 0 (FTP75: 300.0) Sec. • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .
P0010 "A" Camshaft Position Actuator Control Circuit/Open Bank 1	VVT Actuator Intake Open Circuit	• Output voltage, lower range 1.92 to 2.21 V • Output voltage, upper range (hardware values) 2.85 to 3.25 V	• Actuator commanded off	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0011 "A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	VVT Actuator Intake Rationality Check	• Camshaft position deviation > 10.0° CRK	• Modeled oil temperature -40 to 160° C • Engine speed 608 to 6,016 RPM • Camshaft position n.a. • Camshaft position adjustment active • Catalyst heating n.a.	• 0 (FTP75: 250.0) Sec. • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0016 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Camshaft Position/ Crankshaft Position Intake - Correlation Adaptation Value Monitoring	• Adapted value for each edge of the target wheel < -14.00° CRK Or • Adapted value for each edge of the target wheel > 14.00° CRK	• Camshaft adjustment (exhaust side) active • Engine speed 288 to 4,000 RPM • Modeled oil temperature >= -15° C • Modeled oil temperature <= 160° C • Engine speed < 8,160 RPM • Diff. actual exhaust camshaft position vs. previous camshaft position @ reference signal edge < 2.00° CRK And • Case 1: • Ignition off • Engine speed > 380 RPM • Engine stalling >= 1.0 sec. • Or • Case 2: • Engine speed >= 380 RPM Or • Engine running And • Engine stalling >= 5.0 sec. Or • Case 3: • Backwards rotation not detected Or • Case 4: • Engine speed >= 400 RPM • Engine stopped	• 720.0° CRK • Multiple	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 . – Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.6.10 ngine Speed Sensor G28, Checking", page 540 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0030 HO2S Heater Control Circuit Bank 1 Sensor 1	Oxygen Sensors Heater Front Open Circuit	• O2S upstream heater voltage, lower range 1.92 to 2.21 V • O2S upstream heater voltage, upper range 2.85 to 3.25 V		• 2.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0031 HO2S Heater Control Circuit Low Bank 1 Sensor 1	Oxygen Sensors Heater Front Short To Ground	• O2S upstream heater voltage < 1.92 to 2.21 V		• 2.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0032 HO2S Heater Control Circuit High Bank 1 Sensor 1	Oxygen Sensors Heater Front Short To Battery Plus	• O2S upstream heater driver temperature > 160.0 to 200.0° C • Or • O2S upstream heater driver output current > 8.0 to 12.0 A	• EGT @ O2S front n.a. • Actuator commanded off	• 2.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0033 Turbocharger/Supercharger Bypass	Turbocharger Deceleration Bypass Valve Open Circuit	• Voltage, lower range 1.92 to 2.21 V • Voltage, upper range (hardware values) 2.85 to 3.25 V	• Actuator commanded off	• 1.0 Sec. • Continuous	• 2 DCY	– Check the Turbocharger Recirculation Valve -N249-. Refer to ⇒ T3.6.32 urbocharger Recirculation ValveN249,

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
Valve "A" Control Circuit	Turbocharger Deceleration Bypass Valve Short To Battery Plus	• Current > 4.0 to 7.0 A • Or • Temperature (hardware values) > 160 to 200° C	• Actuator commanded on	• 1.0 Sec. • Continuous	• 2 DCY	Checking", page 588 .
P0034 Turbocharger/Supercharger Bypass Valve "A" Control Circuit Low	Turbocharger Deceleration Bypass Valve Short To Ground	• Voltage (hardware values) < 1.92 to 2.21 V	• Actuator commanded off	• 1.0 Sec. • Continuous	• 2 DCY	– Check the Turbocharger Recirculation Valve -N249-. Refer to ⇒ T3.6.32 urbocharger Recirculation ValveN249, Checking", page 588 .
P0036 HO2S Heater Control Circuit Bank 1 Sensor 2	Oxygen Sensors Heater Rear Open Circuit	• O2S downstream heater voltage, lower range 1.92 to 2.21 V • O2S downstream heater voltage, upper range 2.85 to 3.25 V	• Engine not in start process	• 2.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0037 HO2S Heater Control Circuit Low Bank 1 Sensor 2	Oxygen Sensors Heater Rear Short To Ground	• O2S downstream heater voltage < 1.92 to 2.21 V	• Engine not in start process	• 2.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0038 HO2S Heater Control Circuit High Bank 1 Sensor 2	Oxygen Sensors Heater Rear Short To Battery Plus	• O2S downstream heater driver temperature > 160.0 to 200.0° C • Or • O2S downstream heater driver output current > 8.0 to 12.0 A	• EGT @ O2S rear (binary) >= 300° C • Actuator commanded on • Engine not in start process	• 2.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0045 Turbocharger/Supercharger Boost Control "A" Circuit/Open	Turbocharger Boost Pressure Control Valve Open Circuit	• Bypass valve driver load resistance > 200 kOhm	• Deviation between actual and filtered boost pressure actuator position <= 5.0% • Boost pressure actuator controller not active • Time delay > 1.0 sec .	• 0.4 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .
P0049 Turbocharger/Supercharger "A" Turbine Overspeed	Turbocharger Out Of Range High	• Turbocharger speed >= 240,002 RPM • Or • IAT @ throttle >= 336° C • For time >= 6.0 sec.	• Engine running	• 2.6 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0068 MAP /MAF - Throttle Position Correlation	Manifold Pressure Sensor Large Leakage Detection	• Diff. MAP setpoint vs. actual MAP < -15.00 to -10.00 kPa	• Fast throttle adaptation finished • MAP gradient -200.00 to 200.00 kPa/sec. • Vehicle speed <= 2 km/h • Time after engine start > 5.0 sec. • Engine speed, lower range > 576 RPM • Engine speed, upper range < 3000 RPM • IAT @ manifold > -48° C • ECT @ cylinder block > -48° C • Pressure quotient @ throttle 0.10 to 0.60 [-] • Load dynamic conditions: • Dynamic engine speed < 8,160 RPM • Dynamic air mass < 25.01 mg/rev	• 5.0 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Intake Air System Rationality Check	• Throttle cross-sectional area correction included controller and adaptation < -60.0% • Lambda correction included controller and adaptation -28.0 to 28.0% • Lambda controller active	• Intake manifold modeled adaptation active (by throttle opening area) • Throttle position 0.0 to 100.003° TPS • Engine speed 576 to 3,008 RPM • Pressure quotient @ throttle 0.27 to 0.60 [-] • Fast throttle adaptation finished • MAP gradient -200.0 to 200.0 kPa/sec. • Fuel cut off not active • Time after engine start > 5.0 sec. • Boost pressure 73.00 to 107.50 kPa • BARO 73.0 to 107.50 kPa			
P0070 Ambient Air Temperature Sensor Circuit "A"	CAN: Ambient Air Temperature Sensor Short To Battery / Open Circuit	• AAT sensor voltage (hardware values) > 4.50 V		• 2.0 Sec. • Continuous	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ Ö3.6.23 utside Air Temperature SensorG17, Checking", page 568 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0071 Ambient Air Temperature Sensor Circuit "A" Range/Performance	Ambient Air Temperature Sensor Cross Check	• Diff. AAT vs IAT @ first engine start (depending on engine off time) > 20 K And • Diff. AAT vs ROT @ first engine start (depending on engine off time) > 20 K And • Diff. IAT vs. ROT @ first engine start (depending on engine off time) < 20 K	• Engine off time > 360.0 min. • Decrement check to ensure a cold vehicle state: • Diff. IAT vs. min. IAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 sec. and diff. ROT vs. min. ROT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 sec. • Diff. AAT vs. min. AAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 sec.	• 100.0 Sec. • Once / DCY	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ Ö3.6.23 utside Air Temperature SensorG17, Checking", page 568 .
P0072 Ambient Air Temperature Sensor Circuit "A" Low	CAN: Ambient Air Temperature Sensor Short To Ground	• AAT sensor voltage (hardware values) < 0.10 V		• 2.0 Sec. • Continuous	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ Ö3.6.23 utside Air Temperature SensorG17, Checking", page 568 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel System Pressure Sensor, High Pressure Side Out Of Range Low	• Deviation between reference fuel pressure set point and current fuel pressure > 2,000.10 kPa • Case: 1 • Fuel mass controller output -50.00 to 50.00% • High pressure controller output > 30 mg • Fuel pressure < 2,500.00 kPa • Case 2: • Fuel pump at max limit • Mass fuel flow set point n.a. • Fuel pressure n.a.	• Engine speed 608 to 6,816 RPM • Mass fuel flow set point 15.01 to 1,389.00 mg/rev • For time after request for mass fuel flow set point >= 5.0 sec. • Engine start not active • Time after engine start > 5.0 sec. • Engine warm-up n.a. • Catalyst heating n.a. • Full load n.a. • Catalyst purge n.a. • Lambda control n.a. • Evap purge functionality diagnosis n.a. • And choice of: • Canister load <= n.a. [-] • Or • Evap purge valve n.a.	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel System Pressure Sensor, High Pressure Side Rationality Check Low	• Fuel mass controller output -50.00 to 50.00% • And • High pressure controller output > 35 mg • Deviation betweenfuel pressure set point and current fuel pressure > 2,000.10 kPa • And • Fuel pressure >= 2,500.00 kPa	• Engine speed 608 to 6,816 RPM • Mass fuel flow set point 15.01 to 1,389.00 mg/rev • For time after request for mass fuel flow set point >= 5.0 sec. • Engine start not active • Time after engine start > 5.0 sec. • Engine warm-up n.a. • Catalyst heating n.a. • Full load n.a. • Catalyst purge n.a. • Lambda control n.a. • Evap purge functionality diagnosis n.a. • And choice of: • Canister load <= n.a. [-] • Or • Evap purge valve n.a.	• 5.0 Sec. • Continuous		
P0090 Fuel Pressure Regulator 1 Control Circuit/Open	Fuel Control Valve Open Circuit	• Voltage high side < 1.87 to 2.26 V • Voltage low side > 2.78 to 3.33 V	• Engine speed 0 RPM • Or • Fuel cut off active • Actuator commanded off	• 0.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Low and high side off: • Voltage low side > 2.78 to 3.33 V • Voltage high side < 1.87 to 2.26 V • Low and high side on: • Current low side < 12.2 to 15.0 A • Current high side < 13.5 to 16.5 A	• Engine speed > 600 RPM • And • Fuel cut off not active • Actuator commanded on			
P0091 Fuel Pressure Regulator 1 Control Circuit Low	Fuel Control Valve Short To Ground (High Side)	• Current high side (hardware values) > 13.5 to 17.0 A •	• Ignition on • Or • Ignition off (during ECM keep alive-time) • And • Actuator commanded on	• 0.2 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .
	Fuel Control Valve Short To Ground (Low Side)	• Voltage low side (hardware values) < 1.87 to 2.26 V	• Ignition on • Or • Ignition off (during ECM keep alive-time) • And • Actuator commanded off			
P0092 Fuel Pressure Regulator 1 Control Circuit High	Fuel Control Valve Short To Battery Plus (Low Side)	• Current low side (hardware values) > 13.5 to 17.0 A •	• Ignition on • Or • Ignition off (during ECM keep alive-time) • And • Actuator commanded on	• 0.2 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Control Valve Short To Battery Plus (High Side)	• Voltage high side (hardware values) < 2.78 to 3.33 V	• Ignition on • Or • Ignition off (during ECM keep alive-time) • And • Actuator commanded off			
P00AF Turbocharger/Supercharger Boost Control "A" Module Performance	Turbocharger Boost Pressure Control Valve Functional Check - Transient Check	• Boost pressure actuator position controller output > 98.0% • Boost pressure actuator position controller output < -98.0%	• Time after engine start >= 4.0 sec. • ECT > -40° C • AAT > -40° C • Catalyst heating not active • Boost pressure control active	• 0.4 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor - G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking”, page 533 .
	Turbocharger Boost Pressure Control Valve Functional Check	• Deviation boost pressure actuator position controller > 12.00 to 100.0%				
P0100 Mass or Volume Air Flow Sensor "A" Circuit	Mass or Volume Air Flow Sensor "A" Circuit	• MAF sensor signal 0 µs	• Engine speed > 20 RPM	• 0.2 Sec.	• 2 DCY	– Check the Intake Manifold Sensor - GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking”, page 559 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0101 Mass or Volume Air Flow Sensor "A" Circuit Range/ Performance	Mass or Volume Air Flow Sensor "A" Circuit Range/ Performance	Mass air flow vs. • Upper threshold model > 60 to 800 kg/h • Lower threshold model < 0 to 400 kg/h • Load calculation > 18% • Fuel system < -18%	• Time after engine start, 150 camshaft revolutions • Throttle position < 99.6% • Engine speed 1280 - 6,000 RPM • ECT > 63° C • IAT < 90° C • Mass air flow 0 - 450 kg/h • Engine load 20 - 100% • Lambda control closed loop • EVAP purge valve closed • No low fuel signal	• 2.0 Sec.	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .
P0102 Mass or Volume Air Flow Sensor "A" Circuit Low	Mass or Volume Air Flow Sensor "A" Circuit Low	• MAF sensor signal < 66 µs	• Engine speed > 20 RPM	• 0.2 Sec.	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .
P0103 Mass or Volume Air Flow Sensor "A" Circuit High	Mass or Volume Air Flow Sensor "A" Circuit High	• MAF sensor signal > 4500 µs	• Engine speed > 20 RPM	• 0.2 Sec.	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0106 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Range/Performance	Manifold Pressure Sensor Cross Check	• Case 1: Charged engine • Diff. BARO vs. MAP > 7.50 kPa • Diff. turbocharger boost pressure vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure <= 7.50 kPa • Case 2: Non charged engine • Diff. BARO mean value vs. MAP mean value >= n.a. kPa • Diff. deviation BARO mean value to mean value (MAP mean value, BARO mean value, BARO @ ECM keep alive time and MAP @ ECM keep alive time) <= n.a. kPa • Diff. deviation MAP mean value to mean value (MAP mean value, BARO mean value, BARO @ ECM keep alive time and MAP @ ECM keep alive time) > n.a. kPa • Diff. BARO mean value @ ECM keep alive vs. MAP mean value @ ECM keep alive time > n.a. kPa	• Case A: engine stop during DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a. • For time >= 10.0 sec. • Case B: Engine stop @ start of DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a.	• 3.0 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 . If there is no fault found with the Charge Air Pressure sensor or wiring, check for any related TSB's. The Altitude (Baro) sensor is located within the ECM and will require replacement of the ECM if faulty. Check the Baro reading with a scan tool vs. actual Baro for the area. If Baro is off by more than 10%, replace the ECM. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diff. BARO mean value vs. MAP mean value > n.a. kPa				
		• Case 1: Charged engine • Diff. BARO vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure <= 7.50 kPa • Diff. turbocharger boost pressure vs. MAP > 7.50 kPa • Case 2: Non charged engine • Diff. BARO mean value @ ECM keep alive vs. MAP mean value @ ECM keep alive time > n.a. kPa	• Engine stopped • Vehicle speed < 1 km/h • ECM keep alive time 10.0 to 6,553.5 sec. • Time after engine stop >= 5.0 sec. • BARO sensor voltage 0.20 to 4.80 V • MAP sensor voltage 0.20 to 4.80 V • Boost pressure sensor voltage 0.20 to 4.80 V			
	Intake Air System Rationality Check	• Throttle opening area correction included controller and adaptation > 40.00% • Lambda correction included controller and adaptation < -28.00%	• Intake manifold modeled adaptation active • Throttle position (by throttle opening area) 0.000 to 100.003° TPS • Engine speed 576 to 3,008 RM • Pressure quotient @ throttle 0.27 to 0.60 [-] • Fast throttle adaptation finished • MAP gradient -200.00 to 200.00 kPa/sec • Fuel cut off not active	• 5.0 Sec. • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Throttle opening area correction included controller and adaptation < 40.00% • Lambda correction included controller and adaptation > 28.00%	• Time after engine start > 5.0 sec. • Boost pressure 73.00 to 107.50 kPa • BARO 73.00 to 107.50 kPa			
P0107 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Low	Manifold Pressure Sensor Short To Ground	• Intake manifold pressure sensor voltage < 0.20 V		• 0.5 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .
P0108 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit High	Manifold Pressure Sensor Short To Battery Plus	• Intake manifold pressure sensor voltage > 4.80 V		• 0.5 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0111 Intake Air Temperature Sensor 1 Circuit Range/Performance Bank 1	Intake Air Temperature Sensor Cross Check	• Diff. IAT vs. AAT @ first engine start (depending on engine off time) > 20 K • And • Diff. IAT vs. ROT @ first engine start (depending on engine off time) > 20 K • And • Diff. AAT vs. ROT @ first engine start (depending on engine off time) < 20 K	• Engine off time > 360.00 min • Decrement check to ensure a cold vehicle state: • Diff. IAT vs. min. IAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 sec. • Diff. ROT vs. min. ROT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 sec. • Diff. AAT vs. min. AAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 sec.	• 100.0 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .
P0112 Intake Air Temperature Sensor 1 Circuit Low Bank 1	Intake Air Temperature Sensor Short To Ground	• IAT sensor voltage < 0.10 V		• 2.0 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0113 Intake Air Temperature Sensor 1 Circuit High Bank 1	Intake Air Temperature Sensor Open Circuit	• IAT sensor voltage > 4.50 V		• 2.0 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .
P0116 Engine Coolant Temperature Sensor 1 Circuit Range/Performance	Engine Coolant Temperature Sensor No Change On Signal	• Diff. max. ECT vs. min. ECT < 1.5 K	• ECT range conditions • ECT @ start < 82; > 98° C • And • ECT @ start n.a. • Driving condition H: • Engine part load • Or • Engine full load engine speed > 1300 RPM • Vehicle speed > 50 km/h • Ratio air mass flow to max. air mass flow > 6.0% • Time after conditions are fulfilled > 30.0 to 60.0 sec. • Driving condition L: • Engine idle • Vehicle speed n.a. • Or • Fuel cut off active • Time after conditions are fulfilled > 30 to 60 sec.	• 120.0 Sec. • Once / DCY	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Engine Coolant Temperature Sensor @ Cylinder Block Rationality Check Inappropriately Low	• Diff. min temperature of cross check sensors vs. ECT @ cylinder block @ engine start >= 10° C	• Cross checks finished	• 1.0 Sec. • Once / DCY	• 2 DCY	
	Engine Coolant Temperature Sensor @ Cylinder Block Rationality Check High	• ECT @ cylinder block @ engine start > 40 to 80° C	• Cross checks finished • Engine running • Engine off time >= 240.0 min • Valid AAT signal for time >= 2.0 sec. • Valid engine stop signal for time >= 3.0 sec.			
	Engine Coolant Temperature Sensor @ Cylinder Block Rationality Check Low	• Difference between modeled and measured cylinder block temperature > 10° C	• ECT @ cylinder block -128 to 127° C • Time after engine start > 60.0 sec.	• 10.0 Sec. • Once / DCY	• 2 DCY	
P0117 Engine Coolant Temperature Sensor 1 Circuit Low	Engine Coolant Temperature Sensor Short To Ground	• ECT sensor voltage < 0.30 V		• 0.5 Sec. • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 . – Check the coolant thermostat. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0118 Engine Coolant Temperature Sensor 1 Circuit High	Engine Coolant Temperature Sensor Short To Battery / Open Circuit	• ECT sensor voltage > 4.90 V	• IAT at throttle >= -33° C • Time after engine start > 60.0 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 . – Check the coolant thermostat. Refer to the appropriate repair manual.
P0121 Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	Throttle Position Sensor 1 Rationality Check	• Normalised difference between measured and modeled value of mass air flow from TPS 1 >= 1.00 [-] • Or • Relative mass air flow integral from TPS 1 > 60.00 [-]	• Throttle adaptation not active	• 0.01 Sec. • Continuous .	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
		• Difference between TPS 1 and TPS 2 > 6.499° TPS		• 0.3 Sec. • Continuous		
P0122 Throttle/Pedal Position Sensor/Switch "A" Circuit Low	Throttle Position Sensor 1 Short To Ground	• Throttle position sensor 1 voltage < 0.17 V		• 0.1 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0123 Throttle/ Pedal Position Sensor/ Switch "A" Circuit High	Throttle Position Sensor 1 Short To Battery Plus	• Throttle position sensor 1 voltage > 4.83 V		• 0.1 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P0130 O2 Sensor Circuit Bank 1 Sensor 1	O2 Sensor Circuit Bank 1 Sensor 1	• O2S ceramic temp. < 640° C	• Modeled exhaust temp > 300° C • Fuel cutoff not active	• 12.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0131 O2 Sensor Circuit Low Voltage Bank 1 Sensor 1	Oxygen Sensors Front Short To Ground	• O2S sensor voltage < 0.15 V	• O2S heater front active • Pump current controller active • Measurement of WRAF sensor label resistor not active • Active phase of open circuit diagnosis for linear lambda sensor not active	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0132 O2 Sensor Circuit High Voltage Bank 1 Sensor 1	Oxygen Sensors Front Short To Battery Plus	• O2S sensor voltage > 5.20 to 5.35 V	• O2S heater front active • Pump current controller active • Measurement of WRAF sensor label resistor not active • Active phase of open circuit diagnosis for linear lambda sensor not active	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0133 O2 Sensor Circuit Slow Response Bank 1 Sensor 1	Oxygen Sensors Front Dynamic Path Response Check	• Average check • Mean value of normalised signal amplitude >= 0.80 [-] • Or • Ratio check • Ratio of failed diagnostic cycle > n.a. [-]	• CONDITIONS RANGE 1: (standard parameters) • General conditions • Time after engine start n.a. • ECT >= -48° C • Vehicle speed n.a. • Waiting for MAF integral is flown off after gear is changed n.a. • MAF 0.00 to 1,389.00 mg/rev • Integrated MAF in catalyst per cylinder n.a. • Static conditions • O2S front ready • Lambda stimulation active • Lambda control value -35.00 to 35.00% • Engine speed 928 to 3,008 RPM • MAF to activate diagnosis function 150.00 to 600.00 mg/rev • MAF per segment > 18.00 kg/h • Normalized integrated fuel mass in oil < 255.00 [-] • Catalyst purge not active • Limited dynamic conditions • Integrated MAF after dynamic conditions are fulfilled < n.a. g	• 4.4 Sec. • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Dynamic engine speed < 150 RPM • Dynamic MAF < n.a. mg/rev • Or • Dynamic MAF per segment < 30.00 kg/h • Dynamic lambda < n.a. % • Change of dynamic torque < 0.07 [-] • CONDITIONS RANGE 2: (diagnosis carried out together with the catalyst efficiency diagnosis) • General conditions • Vehicle speed >= 10 km/h • Barometric pressure n.a. • Catalyst overheating protection not active • O2S rear ready • O2S front ready • O2S front pump current valid • O2S heater rear active • Integrated heat energy >= 1,600.00 to 3,000.00 kJ • Or • Time after engine start > 230.0 to 1,000.0 sec. • Engine speed 1,280 to 3,008 RPM • Lambda control value < 50.00%			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Lambda controller deviation < 0.08 to 0.15 [-] • Or • Counter lambda controller deviation > 1.00 [-] • Quickpass trim control ready • Or • Trim control with high demand of adaptation • Proportional part of trim control < 0.25 [-] • Lambda adaptation commanded off • Scavenging not active • Valve lift not active • Time after a catalyst purge phase >= 0.02 sec. • Temperature conditions • ECT > 60° C • IAT > -48° C • Modeled catalyst temp. 500 to 700° C • Modeled catalyst temp. extended range 470 to 730° C • Difference between dynamic and stationary catalyst temp. -254.0 to 254.0 K • Difference between dynamic and stationary catalyst temp. extended range -304.0 to 304.0 K			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Modeled catalyst temperature @ start > 550° C • Integrated MAF, catalyst temp. conditions fulfilled n.a. • Modeled exhaust gas temperature at O2S rear <= 1,201° C • Air mass flow conditions • MAF per cylinder 40.00 to 130.00 kg/h • MAF per cylinder extended range 35.00 to 135.00 kg/h • MAF 125.01 to 580.00 mg/rev • MAF set point 125.01 to 580.00 mg/rev • MAF extended range n.a. mg/rev • Limited dynamics conditions • Dynamic engine speed < 20 RPM • Dynamic lambda controller output <= 20.00% • Dynamic MAF < 25.01 mg/stk • Integrated MAF after dynamic conditions are fulfilled > 20.0 g • Evap purge conditions • Canister load <= 2.00 [-] • Or • Evap purge valve closed			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Close the gap conditions • O2S rear voltage @ diagnosis start >= 0.55 • Integrated MAF to start diagnosis n.a.			
P0135 O2 Sensor Heater Circuit Bank 1 Sensor 1	Oxygen Sensors Heater Front Functional Check	• O2S ceramic temperature < 730° C	• Stir up O2S heater front (linear) finished • For time >= 10.0 sec.	• 20.0 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0136 O2 Sensor Circuit Bank 1 Sensor 2	O2 Sensor Circuit Bank 1 Sensor 2	• Delta voltage one step at heater switching > 2.00 V • Number of checks >= 4	• Sensor voltage <= 0.40 V or 0.50 to 1.08 V.	• 40.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0137 O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	Oxygen Sensors Rear Short To Ground	• O2S sensor voltage < 0.15 V	• O2S heater active	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0138 O2 Sensor Circuit High Voltage Bank 1 Sensor 2	Oxygen Sensors Rear Short To Battery	• O2S sensor voltage > 5.2 to 5.35 V	• O2S heater active	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0139 O2 Sensor Circuit Slow Response Bank 1 Sensor 2	O2 Sensor Circuit Slow Response Bank 1 Sensor 2	• EWMA filtered transient time at fuel cutoff > 0.0 Sec. • In voltage range of 201 - 401 mV • Number of checks, >= 3	• Rich voltage enable > = 547.9 mV • Lean voltage < = 201.2 mV • Fuel cutoff active • O2S rear ready • Modeled exhaust gas temp > 400° C • Front O2 sensor lambda signal > 2.00 V	• 100.0 Sec.	• 1 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P013A O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	Oxygen Sensors Rear Rich To Lean Transition Response Check At Fuel Cut Off	• Gradient sensor voltage (arithmetic average) < 600.0 mV/sec.	• Integrated heat energy n.a. • Modeled catalyst temp. > 400° C • Vehicle speed 47 to 255 km/h • Internal resistance O2S rear < 700.00 Ohm • MAF per cylinder 11.50 to 140.00 kg/h • Sensor voltage at begin of fuel cutoff > 0.67 V • Integrated mass air flow after last fuel cut off >= 85.0 g • Fuel cut off active • Number of checks 2.00 [-]	• 86.5 Sec. • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0140 O2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	Oxygen Sensors Rear Open Circuit	• Internal resistance of O2S (binary) > 65,534.00 Ohm		• 2.5 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0141 O2 Sensor Heater Circuit Bank 1 Sensor 2	Oxygen Sensors Rear Out Of Range High	• internal resistance of O2S (binary) 700.00...65534.00 [Ohm]	• stir up O2S heater front (binary) finished • for time >= 10.0 [s]	• 20.0 Sec. • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0142 O2 Sensor Circuit Bank 1 Sensor 3	O2 Sensor Circuit Bank 1 Sensor 3	• Delta voltage one step at heater > 2.0 V • Number of checks, 4	• Modeled exhaust gas temp 700° C for > 10 sec. • Dew point exceeded and lower exhaust gas temp limit exceeded for 60 sec.	• 40.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0143 O2 Sensor Circuit Low Voltage Bank 1 Sensor 3	O2 Sensor Circuit Low Voltage Bank 1 Sensor 3	Cold/Warm condition • Signal voltage < 0.06 V for > 3 sec.	Cold condition • Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Modeled exhaust gas temp. 700° C for > 10 Sec. • Heater power >= 50% for > 10 Sec.	• 3.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0144 O2 Sensor Circuit High Voltage Bank 1 Sensor 3	O2 Sensor Circuit High Voltage Bank 1 Sensor 3	• Signal voltage > 1.08 V for > 5 Sec.	Cold condition • Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Modeled exhaust gas temp. 700° C for > 10 Sec. • Heater power >= 50% for > 10 Sec.	• 5.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0145 O2 Sensor Circuit Slow Response Bank 1 Sensor 3	O2 Sensor Circuit Slow Response Bank 1 Sensor 3	• EWMA filtered transient time at fuel cutoff > 1.2 sec. • In voltage range of 201.2 - 401.4 mV • Number of checks, 3	• Rich voltage enable > = 548 mV • Lean voltage < = 201.2 mV • Fuel cutoff active • O2S rear ready • Modeled exhaust gas temp > 400° C • Front O2 sensor lambda signal > 2.00 V	• 100.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0146 O2 Sensor Circuit No Activity Detected Bank 1 Sensor 33	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 3	• Signal voltage 0.40 - 0.60 V for > 3 sec. • Internal resistance > 40,000 Ohm	Cold condition • Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Modeled exhaust gas temp. 650° C for > 18 sec. • Heater power >= 50% for > 10 sec.	• 38.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0147 O2 Sensor Heater Circuit Bank 1 Sensor 3	O2 Sensor Heater Circuit Bank 1 Sensor 3	• Heater (ECM internal) resistance 792 - 4,560 ohm	• Modeled exhaust gas temp 250 - 650° C • Engine shutoff time > 60 Sec. • Fuel cutoff not active • Number of checks 10 • Heater commanded on	• 15.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0149 Fuel Timing Error	Injection Valves Supply Voltage Out Of Range Low	• Boost voltage < 30.0 V	• Engine running >= 0.3 sec.	• 3.6 Sec. • Continuous	• 2 DCY	– Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
		• Boost voltage <= 50.0 V				
	Injection Valves Supply Voltage Out Of Range High	• Boost voltage > 75.0 V				
P0169 Incorrect Fuel Composition	Incorrect Fuel Composition	• Fuel quantity incorrect • Fuel correction factor incorrect • Internal check failed	• Engine speed > 1,200 RPM	• 0.52 to 2.08 Sec.	• 2 DCY	– Check for contaminated fuel, long term adaptive out of range, possible O2 sensor fault or high concentration of alcohol in fuel (above 15%).

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0171 System Too Lean Bank 1	Fuel System Too Lean	• Lambda controller output > 35.0%	• Lambda control closed loop • Barometric pressure n.a. • Mass air flow > 60.00 mg/stk • Engine speed > 576 RPM • ECT @ cylinder block > 55° C • IAT at intake manifold > -48° C • AAT > -48° C	• 60.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the intake system for leaks, or engine gaskets, oil cap loose/missing that can allow air in via the PCV system. – Check the vacuum lines for leaks.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0172 System Too Rich Bank 1	Fuel System Too Rich	• Lambda controller output < -35.0%	• Lambda control closed loop • Barometric pressure n.a. • Mass air flow > 60.0 mg/stk • Engine speed > 576 RPM • ECT @ cylinder block > 55° C • IAT at intake manifold > -48° C • AAT > -48° C • Oil dilution not detected	• 60.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0190 Fuel Pressure Regulator 1 Control Circuit/ Open	Fuel System Pressure Sensor, High Pressure Side Short To Battery / Open Circuit	• High fuel pressure sensor voltage > 4.80 V		• 2.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 .
P0191 Fuel Rail Pressure Sensor Circuit Range/ Performance Bank 1	Fuel System Pressure Sensor, High Pressure Side Out Of Range High	• Fuel pressure > 27,900.09 kPa	• Engine running • Engine speed < 8,160 RPM • Time after engine start > 5.0 sec.	• 5.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 .
P0192 Fuel Rail Pressure Sensor Circuit Low Bank 1t	Fuel System Pressure Sensor, High Pressure Side Short To Ground	• High fuel pressure sensor voltage < 0.20 V		• 2.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0201 Cylinder 1 Injector "A" Circuit	Injection Valves Electrical Error	• Indeterminate fault pattern via power-stage diagnosis detected • And • Injector low side voltage < 2.0 V • Injector low side switch current > 25.0 A • Or • Injector low side voltage < 2.0 V • Injector high side switch current > 25.0 A • Or • Injector low side voltage < 2.0 V • Injector low side switch current (hardware values) > 9.0 to 14.0 A • Or • Injector voltage < 2.0 V • Injector low side switch current > 25.0 A • or • Injector voltage < 2.0 V • Injector low side switch current (hardware values) > 9.0 to 14.0 A • Or • Injector load resistance to ground and battery > 20.0 Ohm	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 1 Fuel Injector -N30-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Injector low side switch current > 25.0 A • Or • Injector load resistance to ground and battery > 20.0 Ohm • Injector high side switch current > 25.0 A • Or • Power stage temperature > 150° C				
	Injection Valves Open Circuit	• Fault pattern for open circuit via powerstage diagnosis detected • Injector low side voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
	Injection Valves Short Circuit	• Fault pattern for short circuit via powerstage diagnosis detected • Injector current rise time during peak phase < 0.064 ms				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0202 Cylinder 2 Injector "A" Circuit	Injection Valves Electrical Error	• Indeterminate fault pattern via power-stage diagnosis detected • And • Injector low side voltage < 2.0 V • Injector low side switch current > 25.0 A • Or • Injector low side voltage < 2.0 V • Injector high side switch current > 25.0 A • Or • Injector low side voltage < 2.0 V • Injector low side switch current (hardware values) > 9.0 to 14.0 A • Or • Injector voltage < 2.0 V • Injector low side switch current > 25.0 A • or • Injector voltage < 2.0 V • Injector low side switch current (hardware values) > 9.0 to 14.0 A • Or • Injector load resistance to ground and battery > 20.0 Ohm	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 2 Fuel Injector -N31-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Injector low side switch current > 25.0 A • Or • Injector load resistance to ground and battery > 20.0 Ohm • Injector high side switch current > 25.0 A • Or • Power stage temperature > 150° C				
	Injection Valves Open Circuit	• Fault pattern for open circuit via powerstage diagnosis detected • Injector low side voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
	Injection Valves Short Circuit	• Fault pattern for short circuit via powerstage diagnosis detected • Injector current rise time during peak phase < 0.064 ms				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0203 Cylinder 3 Injector "A" Circuit	Injection Valves Electrical Error	• Indeterminate fault pattern via power-stage diagnosis detected • And • Injector low side voltage < 2.0 V • Injector low side switch current > 25.0 A • Or • Injector low side voltage < 2.0 V • Injector high side switch current > 25.0 A • Or • Injector low side voltage < 2.0 V • Injector low side switch current (hardware values) > 9.0 to 14.0 A • Or • Injector voltage < 2.0 V • Injector low side switch current > 25.0 A • or • Injector voltage < 2.0 V • Injector low side switch current (hardware values) > 9.0 to 14.0 A • Or • Injector load resistance to ground and battery > 20.0 Ohm	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	0.5 Sec.	• 2 DCY	– Check the Cylinder 3 Fuel Injector -N32-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Injector low side switch current > 25.0 A • Or • Injector load resistance to ground and battery > 20.0 Ohm • Injector high side switch current > 25.0 A • Or • Power stage temperature > 150° C				
	Injection Valves Open Circuit	• Fault pattern for open circuit via powerstage diagnosis detected • Injector low side voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
	Injection Valves Short Circuit	• Fault pattern for short circuit via powerstage diagnosis detected • Injector current rise time during peak phase < 0.064 ms				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0204 Cylinder 4 Injector "A" Circuit	Injection Valves Electrical Error	• Indeterminate fault pattern via power-stage diagnosis detected • And • Injector low side voltage < 2.0 V • Injector low side switch current > 25.0 A • Or • Injector low side voltage < 2.0 V • Injector high side switch current > 25.0 A • Or • Injector low side voltage < 2.0 V • Injector low side switch current (hardware values) > 9.0 to 14.0 A • Or • Injector voltage < 2.0 V • Injector low side switch current > 25.0 A • or • Injector voltage < 2.0 V • Injector low side switch current (hardware values) > 9.0 to 14.0 A • Or • Injector load resistance to ground and battery > 20.0 Ohm	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 4 Fuel Injector -N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Injector low side switch current > 25.0 A • Or • Injector load resistance to ground and battery > 20.0 Ohm • Injector high side switch current > 25.0 A • Or • Power stage temperature > 150° C				
	Injection Valves Open Circuit	• Fault pattern for open circuit via powerstage diagnosis detected • Injector low side voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
	Injection Valves Short Circuit	• Fault pattern for short circuit via powerstage diagnosis detected • Injector current rise time during peak phase < 0.064 ms				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0221 Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance	Throttle Position Sensor 2 Rationality Check	• Normalised difference between measured and modeled value of mass air flow from TPS 2 >= 1.00 [-] • Or • Relative mass air flow integral from TPS 2 > 60.00 [-]	• Throttle adaptation not active	• 0.01 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P0222 Throttle/Pedal Position Sensor/Switch "B" Circuit Low	Throttle Position Sensor 2 Short To Ground	• Throttle position sensor 2 voltage < 0.17 V		• 0.1 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P0223 Throttle/Pedal Position Sensor/Switch "B" Circuit High	Throttle Position Sensor 2 Short To Battery Plus	• Throttle position sensor 2 voltage > 4.83 V		• 0.1 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0234 Turbocharger/Supercharger "A" Overboost Condition	Turbocharger Boost Pressure Control Out Of Range High	• Boost pressure > calculated max. plausible value • And • Boost pressure deviation < 209.90 to 265.00 kPa • Or • Turbocharger protection active	• Engine running • Accelerator pedal value > 0.00% • Fuel cut off n.a. • Difference between boost pressure and barometric pressure >= 20.00 kPa	• 1.3 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .
P0236 Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance	Turbocharger Boost Pressure Sensor Cross Check (Engine Standing)	• Diff. turbocharger boost pressure vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure > 7.50 kPa • Diff. BARO vs. MAP <= 7.50 kPa	• Case 1: Engine stop during DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a. • For time >= 10.0 sec. • Case 2: engine stop @ start of DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a.	• 3.0 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Turbocharger Boost Pressure Sensor Cross Check (ECM Keep Alive Time)		• Engine stopped • Vehicle speed < 1 km/h • ECM keep alive-time 10.0 to 6,553.5 sec. • Time after engine stop >= 5.0 sec. • BARO sensor voltage 0.20 to 4.80 V • MAP sensor voltage 0.20 to 4.80 V • Boost pressure sensor voltage 0.20 to 4.80 V			
P0237 Turbocharger/Supercharger Boost Sensor "A" Circuit Low	Turbocharger Boost Pressure Sensor Short To Ground	• Turbocharger boost pressure sensor voltage < 0.20 V		• 0.5 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .
P0238 Turbocharger/Supercharger Boost Sensor "A" Circuit High	Turbocharger Boost Pressure Sensor Short To Battery Plus	• Turbocharger boost pressure sensor voltage > 4.80 V		• 0.5 Sec. • Continuous .	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P025A Fuel Pump Module "A" Control Circuit/ Open	Fuel Pump Open Circuit	• Signal voltage, lower range > 1.92 to 2.21 V • And • Signal voltage, upper range (hardware values) < 2.84 to 3.25 V	• Commanded PWM 9.80 to 90.20% • Fuel pump commanded off	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .
P025C Fuel Pump Module "A" Control Circuit Low	Fuel Pump Short To Ground	• Signal voltage (hardware values > 1.92 to 2.21 V	• Commanded PWM 9.80 to 90.20% • Fuel pump commanded off	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .
P025D Fuel Pump Module "A" Control Circuit High	Fuel Pump Short To Battery Plus	• Power stage temperature > 160.0 to 200.0° C • Or • Signal current (hardware values) > 0.1 to 0.18 A	• Commanded PWM 9.80 to 90.20% • Fuel pump commanded on	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .
P0261 Cylinder 1 Injector "A" Circuit Low	Injection Valves Short To Ground	• Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 1 Fuel Injector -N30-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Injection Valves Short To Ground (High Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current (hardware values) > 25 A	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Injection Valves Short To Ground (Low Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current < 25 A • Injector driver low side switch current (hardware values) > 25 A	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
P0262 Cylinder 1 Injector "A" Circuit High	Injection Valves Short To Battery Plus	• Fault pattern for short to battery plus via power-stage diagnosis detected • Injector voltage > 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 1 Fuel Injector -N30-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Injection Valves Short To Battery Plus (High Side)	• Injector driver voltage > 2.0 V • And • injector driver high side switch current (hardware values) > 25 [A]	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Injection Valves Short To Battery Plus (Low Side)	• Injector driver voltage > 2.0 V • And • injector driver low side switch current (hardware values) > 25 [A]				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0264 Cylinder 2 Injector "A" Circuit Low	Injection Valves Short To Ground	• Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 2 Fuel Injector -N31-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Injection Valves Short To Ground (High Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current (hardware values) > 25 A	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Injection Valves Short To Ground (Low Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current < 25 A • Injector driver low side switch current (hardware values) > 25 A	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
P0265 Cylinder 2 Injector "A" Circuit High	Injection Valves Short To Battery Plus	• Fault pattern for short to battery plus via powerstage diagnosis detected • Injector voltage > 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 2 Fuel Injector -N31-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Injection Valves Short To Battery Plus (High Side)	• Injector driver voltage > 2.0 V • And • injector driver high side switch current (hardware values) > 25 [A]	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Injection Valves Short To Battery Plus (Low Side)	• Injector driver voltage > 2.0 V • And • injector driver low side switch current (hardware values) > 25 [A]				
P0267 Cylinder 3 Injector "A" Circuit Low	Injection Valves Short To Ground	• Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 3 Fuel Injector -N32-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Injection Valves Short To Ground (High Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current (hardware values) > 25 A	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Injection Valves Short To Ground (Low Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current < 25 A • Injector driver low side switch current (hardware values) > 25 A	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
P0268 Cylinder 3 Injector "A" Circuit High	Injection Valves Short To Battery Plus	• Fault pattern for short to battery plus via powerstage diagnosis detected • Injector voltage > 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 3 Fuel Injector -N32-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Injection Valves Short To Battery Plus (High Side)	• Injector driver voltage > 2.0 V • And • injector driver high side switch current (hardware values) > 25 [A]	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Injection Valves Short To Battery Plus (Low Side)	• Injector driver voltage > 2.0 V • And • injector driver low side switch current (hardware values) > 25 [A]				
P0270 Cylinder 4 Injector "A" Circuit Low	Injection Valves Short To Ground	• Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 4 Fuel Injector -N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Injection Valves Short To Ground (High Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current (hardware values) > 25 A	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Injection Valves Short To Ground (Low Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current < 25 A • Injector driver low side switch current (hardware values) > 25 A	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0271 Cylinder 4 Injector "A" Circuit High	Injection Valves Short To Battery Plus	• Fault pattern for short to battery plus via power-stage diagnosis detected • Injector voltage > 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 4 Fuel Injector -N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Injection Valves Short To Battery Plus (High Side)	• Injector driver voltage > 2.0 V • And • injector driver high side switch current (hardware values) > 25 [A]	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Injection Valves Short To Battery Plus (Low Side)	• Injector driver voltage > 2.0 V • And • injector driver low side switch current (hardware values) > 25 [A]				
P0299 Turbocharger/Supercharger "A" Underboost Condition	Turbocharger Boost Pressure Control Out Of Range Low	• Boost pressure < calculated min. plausible value • And • Boost pressure deviation > 5.00 kPa	• Engine running • Turbo charger bypass valve closed • For time >= 1.0 sec. • Pressure ratio before charger set point > 1.30 [-] • For time >= 1.2 to 1.9 sec. • Engine speed > 2,208 to 2,750 RPM • Barometric pressure > 73.00 kPa • ECT > -10 • No cylinder is shut off fuel tank level n.a.	• 4.0 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 – Check the charge air system for proper seal. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Leak to Intake Manifold Adaptive Value Check	• Turbo charger actuator set point >= 17.0 to 20.0%	• Engine running • Conditions: • For time >= 0.5 sec. • Difference between filtered boost pressure and basic boost pressure > 40.01 kPa • Difference between filtered boost pressure set point and basic boost pressure > 40.01 kPa • Boost pressure control deviation < 20.0 kPa • Boost pressure set point < 16.0 kPa • Actual boost pressure < 30.0 kPa • Difference between current boost pressure set point and basic boost pressure > 3.0 kPa • ECT > -20° C • IAT @ throttle > 0° C • Engine speed 2,500 to 6,800 RPM • Condition: • For time >= 5,000 ms. • Difference between actual turbocharger speed and maximum turbocharger speed set point > 9,003 RPM • Conditions: • For time >= 1,000 ms.	• 0.01 Sec. • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• No gear shift • Fuel cut off not active			
P0300 Random/Multiple Cylinder Misfire Detected	Misfire Crankshaft Speed Fluctuation (Multiple)	• Number of cylinders with emission threshold misfire within 4,000 revolutions >= 2.00 [-] • Or • Number of cylinders with emission threshold misfire within 1,000 revolutions >= n.a. [-]	• Emission threshold misfire detected	• 0.0 Sec. • Continuous	• 2 DCY	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
		• Number of cylinders with catalyst damaging misfire >= 2.00 [-]	• Catalyst damaging misfire detected		• Immediately	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0301 Cylinder 1 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	• Catalyst damage misfire within 200 rev For A/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For DC/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For CV/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For M/T: • Catalyst damaging misfire rate > 5.81 to 62.50%	• Initial engine speed > 550 RPM • Engine speed > 550 RPM • Engine speed < 6,848 RPM • Time after engine start > n.a. sec. • And • Depending on transmission mode for M/T: • Engine load > 7.2 to 44.5% • For A/T: • Engine load > 8.0 to 43.0% • And • Depending on ECT @ cylinder block @ start • ECT @ cylinder block @ engine start <= -48° C • Then activation if • ECT @ cylinder block >= 20° C • Or • ECT @ cylinder block @ engine start > -48° C • And • Fuel cut off not active • Or • Single fuel cut off not active • Or • Number of fade out cylinders < 2.00 [-] • And • Dynamic manifold air pressure <= n.a. kPa	• 200 Rev. • Continuous	• Immed.	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 . – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking”, page 553 .
		• Emission threshold misfire within_1,000_rev For A/T: • Emission threshold misfire rate (MR) n.a. • For DC/T: • Emission threshold misfire rate (MR) n.a. • For CV/T: • Emission threshold misfire rate (MR) n.a. • For MT: • Emission threshold misfire rate (MR) n.a.		• 1,000 Rev. • Continuous	• 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Emission threshold misfire within_4,000_rev For A/T: • Emission threshold misfire rate (MR) > 2.75% • For DC/T: • Emission threshold misfire rate (MR) > 2.75% • For CV/T: • Emission threshold misfire rate (MR) > 2.75% • For M/T: • Emission threshold misfire rate (MR) > 2.75%	• Dynamic throttle position <= n.a. °TPS/sec. • And • Engine n.a. • Engine speed < n.a. RPM • Dynamic of ignition angle <= n.a. °CRK • Or • Dynamic of ignition angle <= n.a. °CRK • And • Rough road not detected	• 4 x 1,000 Rev. • Continuous		
P0302 Cylinder 2 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	• Catalyst damage misfire within 200 rev For A/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For DC/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For CV/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For M/T: • Catalyst damaging misfire rate > 5.81 to 62.50%	• Initial engine speed > 550 RPM • Engine speed > 550 RPM • Engine speed < 6,848 RPM • Time after engine start > n.a. sec. • And • Depending on transmission mode for M/T: • Engine load > 7.2 to 44.5% • For A/T: • Engine load > 8.0 to 43.0% • And • Depending on ECT @ cylinder block @ start • ECT @ cylinder block @ engine start <= -48° C	• 200 Rev. • Continuous	• Immed.	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Emission threshold misfire within_1,000_rev For A/T: • Emission threshold misfire rate (MR) n.a. • For DC/T: • Emission threshold misfire rate (MR) n.a. • For CV/T: • Emission threshold misfire rate (MR) n.a. • For MT: • Emission threshold misfire rate (MR) n.a.	• Then activation if • ECT @ cylinder block >= 20° C • Or • ECT @ cylinder block @ engine start > -48° C • And • Fuel cut off not active • Or • Single fuel cut off not active • Or • Number of fade out cylinders < 2.00 [-] • And • Dynamic manifold air pressure <= n.a. kPa	• 1,000 Rev. • Continuous	• 2 DCY	Output Stage , Checking", page 553 .
		• Emission threshold misfire within_4,000_rev For A/T: • Emission threshold misfire rate (MR) > 2.75% • For DC/T: • Emission threshold misfire rate (MR) > 2.75% • For CV/T: • Emission threshold misfire rate (MR) > 2.75% • For M/T: • Emission threshold misfire rate (MR) > 2.75%	• Dynamic throttle position <= n.a. °TPS/sec. • And • Engine n.a. • Engine speed < n.a. RPM • Dynamic of ignition angle <= n.a. °CRK • Or • Dynamic of ignition angle <= n.a. °CRK • And • Rough road not detected	• 4 x 1,000 Rev. • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0303 Cylinder 3 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	• Catalyst damage misfire within 200 rev For A/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For DC/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For CV/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For M/T: • Catalyst damaging misfire rate > 5.81 to 62.50%	• Initial engine speed > 550 RPM • Engine speed > 550 RPM • Engine speed < 6,848 RPM • Time after engine start > n.a. sec. • And • Depending on transmission mode for M/T: • Engine load > 7.2 to 44.5% • For A/T: • Engine load > 8.0 to 43.0% • And • Depending on ECT @ cylinder block @ start • ECT @ cylinder block @ engine start <= -48° C • Then activation if • ECT @ cylinder block >= 20° C • Or • ECT @ cylinder block @ engine start > -48° C • And • Fuel cut off not active • Or • Single fuel cut off not active • Or • Number of fade out cylinders < 2.00 [-] • And • Dynamic manifold air pressure <= n.a. kPa	• 200 Rev. • Continuous	• Immed.	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 . – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking”, page 553 .
		• Emission threshold misfire within_1,000_rev For A/T: • Emission threshold misfire rate (MR) n.a. • For DC/T: • Emission threshold misfire rate (MR) n.a. • For CV/T: • Emission threshold misfire rate (MR) n.a. • For MT: • Emission threshold misfire rate (MR) n.a.		• 1,000 Rev. • Continuous	• 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Emission threshold misfire within_4,000_rev For A/T: • Emission threshold misfire rate (MR) > 2.75% • For DC/T: • Emission threshold misfire rate (MR) > 2.75% • For CV/T: • Emission threshold misfire rate (MR) > 2.75% • For M/T: • Emission threshold misfire rate (MR) > 2.75%	• Dynamic throttle position <= n.a. °TPS/sec. • And • Engine n.a. • Engine speed < n.a. RPM • Dynamic of ignition angle <= n.a. °CRK • Or • Dynamic of ignition angle <= n.a. °CRK • And • Rough road not detected	• 4 x 1,000 Rev. • Continuous		
P0304 Cylinder 4 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	• Catalyst damage misfire within 200 rev For A/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For DC/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For CV/T: • Catalyst damaging misfire rate > 5.81 to 62.50% • For M/T: • Catalyst damaging misfire rate > 5.81 to 62.50%	• Initial engine speed > 550 RPM • Engine speed > 550 RPM • Engine speed < 6,848 RPM • Time after engine start > n.a. sec. • And • Depending on transmission mode for M/T: • Engine load > 7.2 to 44.5% • For A/T: • Engine load > 8.0 to 43.0% • And • Depending on ECT @ cylinder block @ start • ECT @ cylinder block @ engine start <= -48° C	• 200 Rev. • Continuous	• Immed.	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Emission threshold misfire within_1,000_rev For A/T: • Emission threshold misfire rate (MR) n.a. • For DC/T: • Emission threshold misfire rate (MR) n.a. • For CV/T: • Emission threshold misfire rate (MR) n.a. • For MT: • Emission threshold misfire rate (MR) n.a.	• Then activation if • ECT @ cylinder block >= 20° C • Or • ECT @ cylinder block @ engine start > -48° C • And • Fuel cut off not active • Or • Single fuel cut off not active • Or • Number of fade out cylinders < 2.00 [-] • And • Dynamic manifold air pressure <= n.a. kPa	• 1,000 Rev. • Continuous	• 2 DCY	Output Stage , Checking", page 553 .
		• Emission threshold misfire within_4,000_rev For A/T: • Emission threshold misfire rate (MR) > 2.75% • For DC/T: • Emission threshold misfire rate (MR) > 2.75% • For CV/T: • Emission threshold misfire rate (MR) > 2.75% • For M/T: • Emission threshold misfire rate (MR) > 2.75%	• Dynamic throttle position <= n.a. °TPS/sec. • And • Engine n.a. • Engine speed < n.a. RPM • Dynamic of ignition angle <= n.a. °CRK • Or • Dynamic of ignition angle <= n.a. °CRK • And • Rough road not detected	• 4 x 1,000 Rev. • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0321 Ignition/ Distributor Engine Speed Input Circuit Range/ Performance	Ignition/ Distributor Engine Speed Input Circuit Range/ Performance	• Comparison of counted teeth vs reference = incorrect • Monitoring reference gap failure		• 1.5 Sec.	• 2 DCY	– Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.6.10 ngine Speed Sensor G28, Checking", page 540 .
P0322 Ignition/ Distributor Engine Speed Input Circuit No Signal	Ignition/ Distributor Engine Speed Input Circuit No Signal	• Camshaft signal > 3 • Engine speed, no signal		• 2.5 Sec.	• 2 DCY	– Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.6.10 ngine Speed Sensor G28, Checking", page 540 .
P0324 Knock Control System Error	Knock Control System Error	• Signal fault counter (combustion) > 24 Or • Signal fault counter (measuring window) > 2.00	• Engine speed 2,500 RPM	• 0.5 Sec.	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0326 Knock/Combustion Vibration Sensor 1 Circuit Range/Performance Bank 1 or Single Sensor	Knock Sensor Rationality Check Low	• Difference between knock sensor signal and average knock sensor signal < 0.00 to 0.12 V	• ECT @ cylinder block > 60° C • MAF > 229.0 mg/stk	• 4.3 Sec. • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking”, page 561 .
P0327 Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor	Knock Sensor Out Of Range	• Sensor signal < 0.27 to 0.31 V	• ECT @ cylinder block > 60° C • MAF > 229.00 mg/stk • Engine speed > 2,016 RPM	• 4.0 Sec. • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking”, page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0328 Knock/ Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor	Knock/ Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor	• Upper threshold > 1.00 V Or for signal range check • > 15 - 115.87 V	• Engine speed, > 1,000 RPM Or for signal range check • ECT > 40.5° C • Engine load > 35 - 60% • Engine speed > 2,000 RPM	• 0.5 Sec.	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .
P0335 Crankshaft Position Sensor "A" Circuit	Crankshaft Position Sensor Out Of Range	• Pulse width backwards < 62; > 150 [µs] • For number of pulse widths outside tolerance > 1.00 [-] • Or • Pulse width forwards < 15; > 62 [µs] • For number of pulse widths outside tolerance > 1.00 [-]	• Engine speed > 32; < 1200 RPM	• 1,800.0° CRK • Continuous	• 2 DCY	– Check the Camshaft Position Sensor - G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Crankshaft Position Sensor Activity Check	• Case 1: • Counted exhaust camshaft signals without synchronisation >= n.a [-] • Or • Counted intake camshaft signals without synchronisation >= n.a. [-] • Case 2: • Counted exhaust camshaft signals without synchronisation n.a. • Or • Counted intake camshaft signals without synchronisation >= 17.0 [-]	• Signal edges @ selected camshaft signal detected • Choice of: • Ignition off • Engine speed > 380 RPM • Engine stalling >= 1.0 sec. • Or • Synchronisation test incorrect • Or • Engine speed >= 380 RPM • Or • Engine running • Engine stalling >= 5.0 sec. • Or • Backwards rotation not detected • Or • Engine speed >= 400 RPM • Engine stop active	• 0.01 Sec. • Continuous		
P0336 Crankshaft Position Sensor "A" Circuit Range/ Performance	Crankshaft Position Sensor Rationality Check	• Crankshaft synchronization lost	• Engine running	• 2,160.0° CRK • Continuous	• 2 DCY	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .
		• One or two additional teeth recognized incorrect • Or • One or two teeth missed	• Engine speed > 320 RPM	• 1,800.0° CRK • Continuous	• 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Sensor signal < 50 to 156 [µs] • And • Engine speed > 1,200 RPM • Sensor signal < 30 [µs] • And • Engine speed <= 1,200 RPM	• Engine running	• 45,720.0° CRK • Continuous	• 2 DCY	
	Crankshaft Position Sensor Out Of Range	• Segment adaptation >= 7.0%	• Fuel cut off all cylinders active • Segments in fuel cut-off mode >= 32.0 [-]	• 180.0° CRK • Continuous	• 2 DCY	
P0340 Camshaft Position Sensor "A" Circuit Bank 1 or Single Sensor	Camshaft Position Sensor Intake Signal Activity Check	• Signal change not detected • For number of reference gap >= 3.00 [-]	• Engine speed > 32 RPM	• 2,520° CRK • Continuous	• 2 DCY	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .
P0341 Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single	Camshaft Position Sensor Intake Signal Activity Check	• Segment time value < 50 µs	• Engine speed > 32; < 8,160 RPM	• 1,440.00° CRK • Continuous	• 2 DCY	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .
	Camshaft Position Sensor Intake Angular Offset Check	• Offset between camshaft and crankshaft < -79.00; > 15.00° CRK	• Engine speed > 32 RPM	• 450.0° CRK • Once / DCY		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
Sensor	Camshaft Position Sensor Intake Rationality Check	• Segment period ratio factor < 0.36; > 2.75 [-] • Or • Offset between camshaft and crankshaft < -79.0; > 15.0° CRK	• Engine speed > 32; < 8,160 RPM	• 952.50° CRK • Continuous		
P0342 Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor	Camshaft Position Sensor "A" Circuit Low Bank 1 Or Single Sensor	• Signal voltage low • Crankshaft signals = 8		• 0.5 Sec.	• 2 DCY	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .
P0343 Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor	Camshaft Position Sensor "A" Circuit High Bank 1 Or Single Sensor	• Signal voltage high • Crankshaft signals = 8		• 0.5 Sec.	• 2 DCY	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .
P0351 Ignition Coil "A" Primary Control Circuit/Open	Ignition Coil "A" Primary Control Circuit/Open	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0352 Ignition Coil "B" Primary Control Circuit/Open	Ignition Coil "B" Primary Control Circuit/Open	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N127-. Refer to ⇒ Ï3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P0353 Ignition Coil "C" Primary Control Circuit/Open	Ignition Coil "C" Primary Control Circuit/Open	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N291-. Refer to ⇒ Ï3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P0354 Ignition Coil "D" Primary Control Circuit/Open	Ignition Coil "D" Primary Control Circuit/Open	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N292-. Refer to ⇒ Ï3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P039B Cylinder 1 Pressure Too High	Knock Control Function Check	• Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] • For time >= 9,000.0 to 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] • For time >= 5,760.0 to 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] • For time >= 12,960.0 to 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 to 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 to 501.0 mg/stk • Dynamic engine speed not active • Delay time n.a.	• 900.0° CRK • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Fast detection: • Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] • For time >= 540.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] • For time >= 360.0° CRK • Case 1: • Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] • Or • Case 2: • Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] • Or • Case 3: • Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] • Or • Ratio between normalised en-	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 to 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 to 501.0 mg/stk • Misfire detection active • Dynamic engine speed not active • Delay time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		gine roughness and misfire detection threshold <= n.a. [-]				
P03A5 Cylinder 2 Pressure Too High	Knock Control Function Check	• Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] • For time >= 9,000.0 to 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] • For time >= 5,760.0 to 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] • For time >= 12,960.0 to 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 to 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 to 501.0 mg/stk • Dynamic engine speed not active • Delay time n.a.	• 900.0° CRK • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Fast detection: • Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] • For time >= 540.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] • For time >= 360.0° CRK • Case 1: • Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] • Or • Case 2: • Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] • Or • Case 3: • Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] • Or • Ratio between normalised en-	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 to 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 to 501.0 mg/stk • Misfire detection active • Dynamic engine speed not active • Delay time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		gine roughness and misfire detection threshold <= n.a. [-]				
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	• Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] • For time >= 9,000.0 to 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] • For time >= 5,760.0 to 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] • For time >= 12,960.0 to 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 to 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 to 501.0 mg/stk • Dynamic engine speed not active • Delay time n.a.	• 900.0° CRK • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Fast detection: • Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] • For time >= 540.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] • For time >= 360.0° CRK • Case 1: • Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] • Or • Case 2: • Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] • Or • Case 3: • Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] • Or • Ratio between normalised en-	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 to 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 to 501.0 mg/stk • Misfire detection active • Dynamic engine speed not active • Delay time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		gine roughness and misfire detection threshold <= n.a. [-]				
P03B9 Cylinder 4 Pressure Too High	Knock Control Function Check	• Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] • For time >= 9,000.0 to 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] • For time >= 5,760.0 to 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] • For time >= 12,960.0 to 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 to 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 to 501.0 mg/stk • Dynamic engine speed not active • Delay time n.a.	• 900.0° CRK • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Fast detection: • Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] • For time >= 540.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] • For time >= 360.0° CRK • Case 1: • Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] • Or • Case 2: • Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] • Or • Case 3: • Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] • Or • Ratio between normalised en-	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 to 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 to 501.0 mg/stk • Misfire detection active • Dynamic engine speed not active • Delay time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		gine roughness and misfire detection threshold <= n.a. [-]				
P0410 AIR System "A"	AIR System "A"	• Deviation SAI pressure sensor > 5.0 kPa	• Mass air flow 7 - 140 kg/h • Delta engine load -7 to 7% • ECT 5.3 - 50.3° C • IAT 5.3 - 60° C • Altitude < 2,700 m • SAI press sensor ready, no fault	• 0.5 Sec. • Once/DCY	• 2 DCY	– Check the Secondary Air Injection Pump Motor -V101-. Refer to ⇒ S3.6.27 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 577 .
P0413 AIR System Switching Valve "A" Circuit Open	AIR System Switching Valve "A" Circuit Open	• Signal voltage 4.70 - 5.40 V	• Air valve commanded off • Engine speed > 80 RPM	• 0.5 Sec.	• 2 DCY	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0414 AIR System Switching Valve "A" Circuit Shorted	AIR System Switching Valve "A" Circuit Shorted	• Signal voltage 0 to 3.25 V Or • Signal current > 2.20 A	• Air valve commanded off • Engine speed > 80 RPM Or • Air valve commanded on • Engine speed > 80 RPM	• 0.5 Sec.	• 2 DCY	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)”, page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)”, page 581 .
P0418 AIR System Control "A" Circuit	AIR System Control "A" Circuit	• Signal voltage 4.70 - 5.40 V	• Pump relay commanded off • Engine speed > 80 RPM	• 0.5 Sec.	• 2 DCY	– Check the Secondary Air Injection Pump Motor -V101-. Refer to ⇒ S3.6.27 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking”, page 577 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0420 Catalyst System Efficiency Below Threshold Bank 1	Catalyst System NMOG / NMHC / NOX Conversion Capability	• Cat efficiency (arithmetic average) > 1.00 [-]	• General conditions • Vehicle speed >= 10 km/h • Barometric pressure n.a. • Catalyst overheating protection not active • O2S rear ready • O2S front ready • O2S front pump current valid • O2S heater rear active • Integrated heat energy >= 1600.00...3000.00 [kJ] • Or • Time after engine start > 230.0...1000.0 [s] • Engine speed 1280...3008 [rpm] • Lambda control value < |50.00| [%] • Lambda controller deviation < | 0.08...0.15| [-] • Quickpass trim control ready • Proportional part of trim control < | 0.25 | [-] • Lambda adaptation commanded off • Scavenging not active • Valve lift not active • Time after a catalyst purge phase >= 0.02 sec. • Number of checks 3.00 [-] • Temperature conditions	• 86.5 Sec. • Once / DCY	• 2 DCY	– Check the Three Way Catalytic Converter (TWC). Refer to ⇒ W3.6.30 ay Catalytic Converter (TWC), Checking", page 584 . – Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• ECT > 60° C • IAT > -48° C • Modeled catalyst temp. 500 to 700° C • Modeled catalyst temp. extended range 470 to 730° C • Integrated MAF, catalyst temp. conditions fulfilled > n.a. g • Difference between dynamic and stationary catalyst temp. -254.0 to 254.0 K • Difference between dynamic and stationary catalyst temp. extended range -304.0 to 304.0 K • Modeled catalyst temperature @ start > 550° C • Modeled exhaust gas temperature at O2S rear <= 1201° C • Air mass flow conditions • MAF per cylinder 40.00 to 130.00 [kg/h] • MAF per cylinder extended range 35.00 to 135.00 kg/h • MAF 125.01 to 580.00 mg/rev • MAF set point 125.0 to 580.0 mg/rev • MAF extended range n.a. mg/rev • Limited dynamics conditions • Dynamic engine speed < 20 RPM			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Dynamic lambda controller output <= 20.00 % • Dynamic MAF < 25.01 mg/stk • Integrated MAF after dynamic conditions are fulfilled > 20.0 g • Evap purge conditions • Canister load <= 2.00 [-] • Or • Evap purge valve closed • Close the gap conditions • O2S rear voltage @ diagnosis start >= 0.55 V • Integrated MAF to start diagnosis n.a. • O2S front dynamic diagnosis separate not active			
P043E EVAP System Leak Detection Reference Orifice Low Flow	EVAP System Out Of Range High	• EVAP pump current during reference measurement > 40.0 mA	• Barometric pressure > 73.00 kPa • AAT 4 to 38° C • ECT @ start >= 4° C • Time since engine start in preceding DCY >= 600.0 sec. • Difference between ECT and AAT @ start <= 20.3 K • Engine stop (during ECM keep alive-time) air bag not activated	• 624.0 Sec. • Once / DCY	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P043F EVAP System Leak Detection Reference Orifice High Flow	EVAP System Out Of Range Low	• EVAP pump current during reference measurement < 15 mA	• Barometric pressure > 73.00 kPa • AAT 4 to 38° C • ECT @ start >= 4° C • Time since engine start in preceding DCY >= 600.0 sec. • Difference between ECT and AAT @ start <= 20.3 K • Engine stop (during ECM keep alive-time) air bag not activated	• 624.0 Sec. • Once / DCY	• 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0441 EVAP System Incorrect Purge Flow	EVAP Purge Valve Functional Check: Stuck Close	• Ratio actual intake manifold pressure and modeled set point intake manifold pressure < 0.05 [-]	• ECT @ cylinder block > 58° C • Barometric pressure > 73.0 kPa • AAT > 5° C • AAT @ start >= 5° C • Diff. barometric pressure vs. filtered intake manifold pressure > n.a. kPa • Diff. barometric pressure vs. filtered intake manifold pressure > 25.0 to 40.0 kPa • Ratio MAF @ intake manifold and MAF max. > 0.07 to 0.09 [-] • Engine speed 1,180 to 2,800 RPM • Vehicle speed >= 5 km/h • Diff. engine speed vs. filtered engine speed < 90 RPM • Diff. ratio MAF @ intake manifold and MAF max vs. ratio filtered MAF @ intake manifold and MAF max < 0.15 [-] • Diff. modeled intake manifold pressure vs. filtered modeled intake manifold pressure < 1.50 kPa • And • Integrated MAF since engine start >= 0.0 to 5,000.0 g	• 8.5 Sec. • Once / DCY	• 2 DCY	– Check the EVAP System for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 . – Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Lambda control active • Lambda control value -30.00 to 30.00% • O2S front 0.95 to 1.05 [-] • Case 1: • Integrated MAF @ canister purge per driving cycle >= n.a. g • Case 2: • Integrated MAF @ canister purge valve >= 2.1 g • Ratio MAF @ canister purge and MAF per cylinder n.a. • And • Depending on AAT: • AAT >= 30° C • Canister load <= 0.09 [-] • Or • AAT >= 20; < 30° C • Canister load <= 0.09 [-] • Or • AAT < 20° C • Canister load <= 0.32 [-]			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0442 EVAP System Leak Detected (small leak)	EVAP System Small Leak Rationality Check	• Difference pump current vs. rough leak reference current < 0 mA • And • For time >= 600.0 sec.	• Barometric pressure > 73.00 kPa • AAT 4 to 38° C • ECT @ start >= 4° C • Vehicle speed < 1 km/h • Time since engine start in preceding dcy >= 600.0 sec. • Difference between ECT and AAT @ start <= 20.3 K • Engine stop (during ECM keep alive-time)	• 624.0 Sec. • Once / DCY	• 2 DCY	– Check the EVAP System for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks”, page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking”, page 542 . – Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking”, page 563 .
P0444 EVAP System Purge Control Valve "A" Circuit Open	EVAP Purge Valve Open Circuit	• Output voltage, lower range >= 1.92 to 2.21 V • Output voltage, upper range (hardware values) <= 2.85 to 3.25 V	• Engine start not active • Engine running • Evap purge valve opening signal (PWM) > 3.13; <= 98.83% • Actuator commanded off	• 2.0 Sec. • Continuous	• 2 DCY	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking”, page 542 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0445 EVAP System Purge Control Valve "A" Circuit Shorted	EVAP Purge Valve Short To Ground	• Output voltage (hardware values) 1.92 to 2.21 V	• Engine start not active • Engine running • Evap purge valve opening signal (PWM) <= 98.83% • Actuator commanded off	• 2.0 Sec. • Continuous	• 2 DCY	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .
	EVAP Purge Valve Short To Battery Plus	• Actuator temperature 160 to 200° C • Or • Output current (hardware values) > 4.0 to 7.0 A	• Engine start not active • Engine running • Evap purge valve opening signal (PWM) >= 3.13% • Actuator commanded on			
P0447 EVAP System Vent Control Circuit Open	EVAP Leak Detection Pump Valve Open Circuit	• Output voltage, lower range 1.85 to 2.28 V • Output voltage, upper range (hardware values) 2.75 to 3.36 V	• Actuator commanded off	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P0448 EVAP System Vent Control Circuit Shorted	EVAP Leak Detection Pump Valve Short To Ground	• Output voltage (hardware values) < 1.85 to 2.28 V	• Actuator commanded off	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
	EVAP Leak Detection Pump Valve Short To Battery Plus	• Actuator temperature > 155 to 185° C • Or • Output current (hardware values) > 1.0 to 2.0 A	• Actuator commanded on			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0455 EVAP System Leak Detected (large leak)	EVAP System Leak Detected (Large Leak)	Time for pressure drop < 1 Sec.	• Time after engine start 12 - 65,530 sec. • ECT 5 - 120° C • ECT at start 5 - 50° C • Engine off time > 21,600 Sec. • Ambient air temp 5 - 59° C • Ambient air temp drop after start < 12° K • Intake manifold vac. > -2,560 hPa • Altitude < 2,700 m • Veh. speed >= 0 • Veh speed once > 40 km/h • Any drive gear • Restart temp diff. > 0° K • Purge valve closed • LDP active	• 136.0 Sec.	• 2 DCY	– Check the EVAP System for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 . – Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0456 EVAP System Leak Detected (Very Small Leak)	EVAP System Leak Detected (Very Small Leak)	• Time for pressure drop, < 4.5 - 6.0 Sec.	• Time after engine start 12 - 1,000 sec. • ECT 3.8 - 120° C • ECT at start 3.8 - 50.3° C • Engine off time > 21,600 sec. • Ambient air temp 3.8 - 59.3° C • Ambient air temp drop after start < 4.5° K • Intake manifold vac. > -2,560 hPa • Intake manifold vac. > -2 560 hPa • Altitude < 2,700 m • Veh. speed >= 0 • Veh speed once > 40 km/h • Any drive gear • Restart temp diff. > 0 K • Purge valve closed • LDP active	• 180.0 Sec. • Once / DCY	• 2 DCY	– Check the EVAP System for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 . – Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P0458 EVAP System Purge Control Valve "A" Circuit Low	EVAP System Purge Control Valve "A" Circuit Low	Signal voltage 0 - 3.26 V	• EVAP purge valve, commanded off • Engine speed > 80 RPM	• 0.5 Sec.	• 2 DCY	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0459 EVAP System Purge Control Valve "A" Circuit High	EVAP System Purge Control Valve "A" Circuit High	Signal current > 2.2 A	• EVAP purge valve, Commanded On • Engine speed > 80 RPM	• 0.5 Sec.	• 2 DCY	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .
P0491 AIR System Insufficient Flow Bank 1	AIR System Insufficient Flow Bank 1	SAI pressure sensor vs modeled pressure < 60 to 75%	• Mass airflow 7 - 140 kg/h • Delta engine load -7 to 7% • ECT 5.3 - 50.3° C • IAT 5.3 - 60° C • Altitude <2,700 • SAI press sensor, ready - no fault	• 43.5 Sec.	• 2 DCY	– Check the Secondary Air System. Refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .
P050A Cold Start Idle Control System Performance	Cold Start Idle Control System Performance	Out of range low: • Engine speed deviation < -80 RPM Out of range high: • Engine speed deviation > 80 RPM	Out of range low: • Time after engine start > 0 sec. • Engine speed, idle • Veh speed 0 km/h • Altitude < 2,700 m • IAT > -48.0° C • Catalyst heating active • ECT < 143° C • Lambda control active • EVAP purge adaptation < 22 • External torque request active	• 3.0 - 5.0 Sec.	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P050B Cold Start Ignition Timing Performance	Cold Start Ignition Timing Performance	Difference between commanded spark timing vs. actual value > 20%	• Time during catalyst heating > 12 sec. • Commanded spark retard during catalyst heating < 100% • Idle speed not active • Vehicle speed >= 5 km/h • Delta engine load <= 10.01% • Delta engine speed <= 100 RPM	• 10.0 Sec. • Once / DCY	• 2 DCY	– Check for any Engine Speed sensor or Ignition Coil faults and diagnose them first. If NO other codes are set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0501 Vehicle Speed Sensor "A" Circuit Range/Performance	CAN: Vehicle Speed Sensor CAN Communication With Vehicle Speed Sensor	• Speed sensor fault value: out of range high failure • Speed sensor fault value: out of range low failure • Speed sensor fault value: rationality check high failure • Speed sensor fault value: rationality check low failure		• 0.5 Sec. • Continuous	• 2 DCY	– Check vehicle speed signal. Refer to ⇒ S3.6.33 peed Signal, Checking", page 589 .
P0502 Vehicle Speed Sensor "A" Circuit Low	Vehicle Speed Sensor Electrical Check	• Vehicle speed sensor signal: electrical error failure		• 0.5 Sec. • Continuous	• 2 DCY	– Check vehicle speed signal. Refer to ⇒ S3.6.33 peed Signal, Checking", page 589 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0503 Vehicle Speed Sensor "A" Circuit Intermittent/ Erratic/ High	Vehicle Speed Sensor "A" Circuit Intermittent/ Erratic/High	Vehicle speed > 290 km/h		• 0.5 Sec.	• 2 DCY	– Check vehicle speed signal. Refer to ⇒ S3.6.33 peed Signal, Checking", page 589 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0506 Idle Air Control System RPM Lower Than Expected	Idle Controller Function Monitoring: Engine Speed Deviation	• Diff. actual engine speed vs. engine speed setpoint < -100 RPM • Integrated I-part of idle speed controller n.a.	• General conditions: • Vehicle speed = 0 km/h torque safety limitation not active • Driver request not active • Throttle actuator commanded on • Evap purge flow < 8.00 kg/h • Engine running • Time after engine start n.a. • Clutch switch n.a. • Barometric pressure > 70.00 kPa • Catalyst heating not active • ECT @ cylinder block > -48° C • And • Set point change < n.a. RPM • For time >= n.a. sec. • And • Additional conditions: • For time n.a. • Gear switch (automatic transmission only) not active • Or • Driver request not active • Or • Vehicle speed 0 km/h • And • Engine load (manual trans-	• 10.0 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			mission only) < 30.47 %			
P0507 Idle Control System RPM - Higher Than Expected	Idle Controller Function Monitoring: Engine Speed Deviation	• Diff. actual engine speed vs. engine speed setpoint > 200 RPM • Integrated I-part of idle speed controller n.a.	• General conditions: • Vehicle speed = 0 km/h torque safety limitation not active • Driver request not active • Throttle actuator commanded on • Evap purge flow < 8.00 kg/h • Engine running • Time after engine start n.a. • Clutch switch n.a. • Barometric pressure > 70.00 kPa • Catalyst heating not active • ECT @ cylinder block > -48° C • And • Set point change < n.a. RPM • For time >= n.a. sec. • And • Additional conditions: • For time n.a. • Gear switch (automatic transmission only) not active • Or • Driver request not active • Or • Vehicle speed 0 km/h	• 10.0 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P052A Cold Start "A" Camshaft Position Timing Over-Advanced Bank 1	Cold Start "A" Camshaft Position Timing Over-Advanced Bank 1	Difference between target and actual position > 6 CRK °	• Time after engine start >= 15 Sec. • Engine speed >= 0 RPM • Modeled oil temperature >= -13° C • Catalyst heating active	• 5.0 Sec.	• 2 DCY	Make sure the correct viscosity oil is used. – Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .
P053F Cold Start Fuel Pressure Performance Bank 2	Cold Start Fuel Pressure Performance Bank 2	• Difference between target pressure vs actual pressure: > 1.50 MPa • Or • < -1.50 MPa	• Time after engine start 3 Sec. • Fuel cutoff not active • Catalyst heating active	• 3.0 Sec.	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .
P05A0 Active Grille Air Shutter "A" Stuck On	Active Grille Air Shutter Functional Check	• Blocked active grille air shutter detected	• AAT n.a.	• 0.3 Sec. • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .
		• Uncontrolled adjustment detected				
P05A2 Active Grille Air Shutter "A" Control Circuit/Open	Active Grille Air Shutter Open Circuit	• Signal voltage, lower range > 1.92 to 2.21 V • Signal voltage, upper range < 2.85 to 3.25 V		• 0.5 Sec.	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .
P05A3 Active Grille Air Shut-	Active Grille Air Shutter Functional Check	• Internal logic failure detected		• 0.3 Sec. • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adia

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
ter "A" Control Circuit Range/ Performance		• Initialisation failure detected		• 0.0 Sec. • Continuous	• 2 DCY	tor Shutter MotorV544, Checking", page 575 .
	Active Grille Air Shutter Activity Check	• Active grille air shutter controller feedback signal failed		• 24.0 Sec. • Continuous	• 2 DCY	
P05A4 Active Grille Air Shutter "A" Control Circuit High	Active Grille Air Shutter Short To Battery Plus	• Power stage temperature > 160.0 to 200.0° C • Or • Signal current > 4.0 to 7.0 A		• 0.5 Sec. • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .
P05A5 Active Grille Air Shutter "A" Control Circuit Low	Active Grille Air Shutter Short To Ground	• Signal voltage < 1.92 to 2.21 V	• Recording time of signal voltage > 3.3 sec. • Active grille air shutter feedback failure not detected	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .
P05C0 Active Grille Air Shutter Module "A" Over Temperature	Active Grille Air Shutter Functional Check	• Internal over voltage detected • Internal overtemperature detected		• 0.3 Sec. • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .
P0601 Internal Control Module	ECM: Checksum Verification	• Calibration checksum incorrect		• 1.0 Sec. • Continuous	• 2 DCY	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
Memory Checksum Error		• Software checksum incorrect				
P0603 Internal Control Module Keep Alive Memory (KAM) Error	ECM: Injection Valves Internal Hardware Check	• Hardware vs. software version check during initialisation failure		• 4.9 Sec. • Once / DCY	• 2 DCY	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
		• Internal hardware check calibration during initialisation failure				
		• Internal hardware check hardware during initialisation failure				
		• Internal hardware check time reference from microcontroller during initialisation failure				
		• Internal hardware check communication between microcontroller and SDI-Driver powerstage failure		• 4320.0° CRK • Continuous		
		• Internal hardware check communication between microcontroller and SDI-Driver powerstage failure		• 360.0° CRK • Once / DCY		
		• Internal hardware check time reference from microcontroller during initialisation missing		• 4320.0° CRK • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Internal hardware check communication between microcontroller and SDI-Driver powerstage failed		• 4320.0° CRK • Continuous		
	ECM: Communication Check	• Device 1: SPI communication with ATIC failure		• 2.0 Sec. • Continuous		
		• Device 2: SPI communication with ATIC failure				
		• SPI communication with ATIC failure				
		• SPI communication with ATIC failure			• 1 DCY	
P0606 Control Module Processor	ECM: EEPROM Check	• EEPROM information failure		• 1.0 Sec. • Continuous	• 2 DCY	– Replace the Engine Control Module - J623-. Refer to the appropriate repair manual.
		• Decryption of NVMCrypt failed		• 1.0 Sec. • Once / DCY		
		• Finished NVMCrypt integrity error				
		• Communication between sample software and production hardware error				
	ECM: Random Access Memory (RAM) Internal Hardware Check	• RAM error detected	• Microcontroller failure • Reset counter > 1.0 [-]	• 0.04 Sec. • Once / DCY		
	ECM: Random Access Memory (RAM) Functional Check			• 0.01 Sec. • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	ECM: A/D Converter Function Monitoring: A/D Converter	• Diff. A/D-channel 1 vs. A/D channel 2 > 0.30 V		• 0.5 Sec. • Continuous		
	ECM: Communication Check	• SPI communication with ATIC failed	• Time after ignition on >= 1.0 sec.	• 10.0 Sec. • Continuous		
		• SPI communication with ATIC implausible				
	ECM: Electronic Throttle Control Module Function Monitoring: Torque	• Monitoring of difference between actual and set point torque value commanded on engine torque overflow > 45.0 to 350.0 Nm	• Throttle actuator commanded on	• 0.5 Sec. • Continuous		
		• Monitoring of torque difference integration integrated engine torque > 550.00 Nms		• 0.01 Sec. • Continuous		
	ECM: Electronic Throttle Control Module Function Monitoring: Engine Speed Limitation	• Engine speed > 1,760 RPM	• Engine speed limitation active • Injection active	• 0.5 Sec. • Continuous		
	ECM: Electronic Throttle Control Module Function Monitoring: A/D Converter	• Internal check failed		• 0.04 Sec. • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Barometric Pressure Sensor Cross Check	• Case 1: Charged engine • Diff. BARO vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure > 7.50 kPa • Case 2: Non-charged engine • Diff. BARO mean value vs. MAP mean value >= n.a. kPa • Diff. deviation BARO mean value to mean value (MAP mean value, BARO mean value, BARO @ ECM keep alive time and MAP @ ECM keep alive time) > n.a. kPa • Diff. deviation MAP mean value to mean value (MAP mean value, BARO mean value, BARO @ ECM keep alive time and MAP @ ECM keep alive time) <= n.a. kPa	• Case A: Engine stop during DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a. • For time >= 10.0 sec. • Case B: Engine stop @ start of DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a.	• 3.0 Sec. • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diff. BARO vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure > 7.50 kPa	• Engine stopped • Vehicle speed < 1 km/h • ECM keep alive-time 10.0 to 6,553.5 sec. • Time after engine stop >= 5.0 sec. • BARO sensor voltage 0.20 to 4.80 V • MAP sensor voltage 0.20 to 4.80 V • Boost pressure sensor voltage 0.20 to 4.80 V			
	Barometric Pressure Sensor Out Of Range High	• Measured barometric pressure > 115.0 kPa		• 5.0 Sec. • Continuous		
	Barometric Pressure Sensor out Of Range Low	• Measured barometric pressure < 45.0 kPa				
P0607 Control Module Performance	Barometric Pressure Sensor Short To Ground	• Barometric pressure sensor voltage < 0.20 V		• 0.5 Sec. • Continuous	• 2 DCY	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
	Barometric Pressure Sensor Short To Battery Plus	• Barometric pressure sensor voltage > 4.80 V				
P062B Internal Control Module Fuel Injector Control Performance	Internal Control Module Fuel Injector Control Performance	Internal logic failure	Engine speed > 80 RPM	• 2.2 Sec.	• 2 DCY	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0634 Control Module Internal Temperature "A" Too High	Turbocharger Boost Pressure Control Valve Over Temperature	• Bypass valve driver temperature (hardware values) > 170 to 190° C	• Control valve commanded on	• 0.4 Sec. • Continuous	• 2 DCY	If an injector circuit code exists, perform diagnosis for that code first as a short will set this fault. – Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0638 Throttle Actuator Control Range/ Performance	Throttle Actuator Basic Settings Adaptation Value Monitoring	• Battery voltage <= 9.04 V	• TPS adaptation commanded on	• 0.01 Sec. • Once per lifetime	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Start Check)	• Difference between actual TPS 1 or 2 voltage and voltage reference position > 0.07 V • Difference between actual throttle and reference position > 0.503° TPS	• Throttle start check active • Accelerator pedal value < 99.90% • Engine speed < 64 RPM • Vehicle speed < 2 km/h • IAT > 5° C • ECT 5 to 101° C	• 0.01 Sec. • Once / DCY		
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Top Limit)	• Difference between actual throttle and reference position > 0.503° TPS	• Throttle adaptation active • Accelerator pedal value < 99.90% • Engine speed < 64 RPM • Vehicle speed < 2 km/h • IAT > 5° C • ECT 5 to 101° C			
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Bottom Limit)	• Difference between actual TPS 1 or 2 voltage and voltage reference position > 0.07 V				
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Mechanical Stop Low)	• TPS 1 voltage < 0.40; > 0.80 V • Or • TPS 2 voltage < 4.20; > 4.60 V				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Limp Home Position)	• Difference between actual TPS 1 or 2 voltage and voltage reference position > 0.25 V				
	Throttle Actuator Basic Settings Adaptation Value Monitoring	• Accelerator pedal value > 99.90% • Or • Engine speed > 64 RPM • Or • Vehicle speed > 2 km/h • Or • IAT @ throttle < 5° C • Or • ECT @ cylinder block < 5° C • Or • ECT @ cylinder block > 101° C	• TPS adaptation commanded on	• 0.01 Sec. • Once per lifetime		
P0641 Sensor Reference Voltage A Circuit Open	Sensor Reference Voltage "A" Circuit/ Open	Signal voltage deviation > +/- 0.3 V		• 0.5 Sec.	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0642 Sensor Reference Voltage "A" Circuit Low	ECM: 5V Supply Voltage Out Of Range Low	• Analog output 1 supply voltage < 4.62 V		• 0.2 Sec. • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0643 Sensor Reference Voltage "A" Circuit High	ECM: 5V Supply Voltage Out Of Range High	• Analog output 1 supply voltage > 5.43 V		• 0.2 Sec. • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0651 Sensor Reference Voltage B Circuit Open	Sensor Reference Voltage "B" Circuit/ Open	Signal voltage deviation > +/- 0.3 V		• 0.5 Sec.	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0652 Sensor Reference Voltage "B" Circuit Low	ECM: 5V Supply Voltage Out Of Range Low	• Analog output 2 supply voltage < 4.62 V		• 0.2 Sec. • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0653 Sensor Reference Voltage "B" Circuit High	ECM: 5V Supply Voltage Out Of Range High	• Analog output 2 supply voltage > 5.43 V		• 0.2 Sec. • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0657 Actuator Supply Voltage "A" Circuit/Open	Supply Voltage Relay Engine Components Open Circuit	• Output voltage, lower range >= 1.90 to 2.30 V • Output voltage, upper range (hardware values) <= 2.80 to 3.20 V	• Relay commanded off	• 1.0 Sec. • Continuous .	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking”, page 565 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0658 Actuator Supply Voltage "A" Circuit Low	Supply Voltage Relay Engine Components Short To Ground	• Output voltage (hardware values) < 1.90 to 2.28 V	• Relay commanded off	• 1.0 Sec. • Continuous	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking", page 565 .
P0659 Actuator Supply Voltage "A" Circuit High	Supply Voltage Relay Engine Components Short To Battery Plus	• Output current > 1.0 to 2.3 A • Or • Actuator temperature (hardware values) > 175 to 195° C	• Relay commanded on	• 1.0 Sec. • Continuous	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking", page 565 .
P0686 ECM /PCM Power Relay Control Circuit Low	Main Relay Rationality Check During Engine Off	• Sensed circuit voltage > 6.0 V	• Main relay commanded off • For time >= 0.3 sec.	• 0.1 Sec. • Continuous	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking", page 565 .
	Main Relay Short To Ground	• Output voltage (hardware values) < 1.85 to 2.28 V	• Relay commanded off • For time > 40 ms.	• 0.2 Sec. • Continuous	• 2 DCY	
P0687 ECM /PCM Power Relay Control Cir-	Main Relay Rationality Check During Engine On	• Sensed circuit voltage < 5.0 V	• Main relay commanded on • For time >= 0.1 sec.	• 0.1 Sec. • Continuous	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Mod-

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
cuit High	Main Relay Short To Battery Plus	• Main relay driver temperature > 175 to 195° C • Or • Main relay output current (hardware values) > 1.0 to 2.3 A	• Main relay commanded on • For time >= 0.4 sec.	• 0.2 Sec. • Continuous	• 2 DCY	ule Power Supply Relay J271, Checking", page 565 .
P0697 Sensor Reference Voltage "C" Circuit/Open	Sensor Reference Voltage "C" Circuit/ Open	Signal voltage deviation > +/- 0.3 V		• 0.5 Sec.	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0698 Sensor Reference Voltage "C" Circuit Low	ECM: 5V Supply Voltage Out Of Range Low	• Analog output 3 supply voltage < 4.62 V		• 0.2 Sec. • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0699 Sensor Reference Voltage "C" Circuit High	ECM: 5V Supply Voltage Out Of Range High	• Analog output 3 supply voltage > 5.43 V		• 0.2 Sec. • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P117A Bank 1 Sensor 2 Control Limit Reached	Bank 1, Oxygen Sensor Correction Center Sensor Control Limit Reached	I portion of 3rd lambda control loop > 0.030	• Engine speed 1,200 to 4,000 RPM • Modeled exhaust gas temp 350 to 1,000° C • Engine load 21.8 to 99.8% • 1st, 2nd, 3rd lambda control in closed loop • O2S rear and heater ready, no faults	• 1,800.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7- in center of the catalytic converter. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P12A1 Fuel Rail Pressure Sensor Inappropriately Low	Fuel System Pressure Sensor High Pressure Side Rationality Check Low	• Fuel mass controller output < -45.00 % • And • High pressure controller output > 8 mg	• Engine speed 608 to 1,088 RPM • Mass fuel flow set point 1.99 to 20.01 mg/rev • For time after request for mass >= 5.0 sec. • Fuel flow set point >= 5.0 sec. • Time after change to DFI n.a. • Time after engine start > 5.0 sec. • Engine warm-up n.a. • Catalyst heating n.a. • Full load n.a. • Catalyst purge n.a. • Lambda control closed loop • Evap purge functionality diagnosis n.a. • And • Choice of: • Canister load <= n.a. [-] • Or • Evap purge valve n.a.	• 10.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking”, page 551 . – Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking”, page 549 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P12A2 Fuel Rail Pressure Sensor Inappropriately High	Fuel System Pressure Sensor High Pressure Side Rationality Check High	• Fuel mass controller output > 30.00% • And • High pressure controller output < -10 mg	• Engine speed 608 to 1,088 RPM • Mass fuel flow set point 4.01 to 29.99 mg/rev • For time after request for mass >= 5.0 sec. • Fuel flow set point >= 5.0 sec. • Time after change to DFI n.a. • Time after engine start > 5.0 sec. • Engine warm-up n.a. • Catalyst heating n.a. • Full load n.a. • Catalyst purge n.a. • Lambda control closed loop • Evap purge functionality diagnosis n.a. • And • Choice of: • Canister load <= n.a. [-] • Or • Evap purge valve n.a.	• 10.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P12A4 Fuel Rail Pump Control Valve Stuck Closed	Fuel System Pressure Sensor, High Pressure Side Out Of Range High	• Deviation between reference fuel pressure set point and current fuel pressure < -2,000.10 kPa • Fuel mass controller output -50.00 to 50.00% • Case: 1 • High pressure controller output < -30 mg • Case 2: • Flow control valve open • Mass fuel flow set point > 15.01 mg/stk	• Engine speed 608 to 6,816 RPM • Mass fuel flow set point 15.01 to 1,389.00 mg/rev • For time after request for mass fuel flow set point >= 5.0 sec. • Engine start not active • Time after engine start > 5.0 sec. • Engine warm-up n.a. • Catalyst heating n.a. • Full load n.a. • Catalyst purge n.a. • Lambda control n.a. • Evap purge functionality diagnosis n.a. • And choice of: • Canister load <= n.a. [-] • Or • Evap purge valve n.a.	• 5.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P13EA Cold Start Ignition Timing Performance Off Idle	Cold Start Ignition Timing Performance Off Idle	Difference between commanded spark timing vs. actual value > 40%	• Time during catalyst heating > 12 sec. • Commanded spark retard during catalyst heating < 100% • Idle speed not active • Vehicle speed >= 5 km/h • Delta engine load <= 10.01% • Delta engine speed <= 100 RPM	• 10.0 Sec. • Once / DCY	• 2 DCY	– Check for any Engine Speed sensor or Ignition Coil faults and diagnose them first. If NO other codes are set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P150A Engine Off Timer Performance	Engine Off Timer Performance	Difference between engine off time and ECM after run time < -12 Sec. or > 12 Sec.	• Key on after ECM after run time active • Key on during ECM after run time active • CAN active	• 6.0 Sec.	• 2 DCY	– If ignition off B+ is lost to ECM, this code will set. Check power and ground inputs to ECM first. Refer to Wiring Diagrams for pin locations. If all power/ grounds to ECM are present, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P1545 Throttle Actuator "A" Control Motor Circuit Range/ Perfor-	Throttle Actuator Out Of Range	• Control duty cycle > 98.0%	• Throttle position not at min. value • Throttle adaptation not active • Throttle actuator commanded on	• 0.7 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
mance	Throttle Actuator Rationality Check	• Difference between throttle position set point and throttle flap opening angle for electronic throttle control > 2.998 to 24.982° TPS	• Throttle adaptation not active • Throttle actuator commanded on • Difference between throttle position set point and throttle flap opening angle <= 1.999; > -1.999° TPS	• 0.5 Sec. • Continuous		
P1609 Crash Shut Down Was Deployed	Airbag Safety Measures Due To Crash With Airbag Activation	Airbag(s) activated		• 0.0 Sec. • Continuous	• 2 DCY	– Erase Engine Control Module -J623- code after proper repair of damage. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 .
P169A Vehicle in Transport Mode	ECM: Transport Mode Function Monitoring: Mode Change	• Transport mode active	• Vehicle speed < 5 km/h • Max trip mileage since initial vehicle start-up < 100.0 km • During ECM keep alive-time after ignition off • Engine speed 0 RPM • Production mode not active • For hybrid: • Drive motor off	• 0.01 Sec. • Continuous	• 1 DCY	– Perform readiness check. Refer to ⇒ C3.2 ode", page 22 .
P2004 Intake Manifold Runner Control Stuck Open Bank 1	Intake Manifold Runner Flap Actuator Stuck Open	• Signal voltage > 0.70 V • For time >= 1.5 sec.	• Flap commanded off • Time after engine start > 5.0 sec.	• 0.2 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve -N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2006 Intake Manifold Runner Control Stuck Closed Bank 1	Intake Manifold Runner Flap Actuator Stuck Close	• Signal voltage > 0.70 V • For time >= 1.5 sec.	• Flap commanded on • Time after engine start > 5.0 sec.	• 0.2 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve - N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .
P2008 Intake Manifold Runner Control Circuit/ Open Bank 1	Intake Manifold Runner Flap Actuator Open Circuit	• Output voltage lower range 1.92 to 2.21 V • Output voltage upper range (hardware values) 2.85 to 3.25 V	• Engine running • Actuator commanded off	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve - N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .
P2009 Intake Manifold Runner Control Circuit Low Bank 1	Intake Manifold Runner Flap Actuator Short To Ground	• Output voltage (hardware values) < 1.92 to 2.21 V	• Engine running • Actuator commanded off	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve - N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .
P2010 Intake Manifold Runner Control Circuit High Bank 1	Intake Manifold Runner Flap Actuator Short To Battery Plus	• Power stage temperature > 160 to 200° C • Or • Output current (hardware values) > 4.0 to 7.0 A	• Engine running • Actuator commanded off	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve - N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2014 Intake Manifold Runner Position Sensor/ Switch Circuit Bank 1	Intake Manifold Runner Flap Position Sensor Short To Ground / Open Circuit	• Intake manifold runner flap position sensor voltage < 0.20 V	• Engine start not active	• 0.04 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Runner Position Sensor -G336-. Refer to ⇒ I3.6.18 ntake Manifold Runner Position SensorG336, Checking", page 557 .
P2015 Intake Manifold Runner Position Sensor/ Switch Circuit Range/ Performance Bank 1	Intake Manifold Runner Position Sensor/Switch Circuit Range/ Performance Bank 1	• Deviation runner flap target position vs actual position > 25% • Actual position 0 to 100%	• Flap commanded on or off • Adaptation ready	• 1.5 Sec.	• 2 DCY	– Check the Intake Manifold Runner Position Sensor -G336-. Refer to ⇒ I3.6.18 ntake Manifold Runner Position SensorG336, Checking", page 557 .
P2016 Intake Manifold Runner Position Sensor Circuit Low	Intake Manifold Runner Position Sensor/Switch Circuit Low Bank 1	Signal voltage < 0.25 V		• 0.3 Sec.	• 2 DCY	– Check the Intake Manifold Runner Position Sensor -G336-. Refer to ⇒ I3.6.18 ntake Manifold Runner Position SensorG336, Checking", page 557 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2017 Intake Manifold Runner Position Sensor/Switch Circuit High Bank 1	Intake Manifold Runner Flap Position Sensor Short To Battery Plus	• Intake manifold runner flap position sensor voltage > 4.80 V	• Engine start not active	• 0.04 Sec. • Continuous	• 2 DCY	– Check the Intake Manifold Runner Position Sensor -G336-. Refer to ⇒ I3.6.18 ntake Manifold Runner Position SensorG336, Checking", page 557 .
P2088 "A" Camshaft Position Actuator Control Circuit Low Bank 1	VVT Actuator Intake Short To Ground	• Output voltage (hardware values) < 1.92 to 2.21 V	• Actuator commanded off	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .
P2089 "A" Camshaft Position Actuator Control Circuit High Bank 1	VVT Actuator Intake Short To Battery Plus	• Power stage temperature > 160 to 200° C • Or • Output current (hardware values) > 8.0 to 12.0 A	• Actuator commanded on	• 2.0 Sec. • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2096 Post Catalyst Fuel Trim System Too Lean Bank 1	Fuel System Out Of Range Low	• adaptation value < -0.05 [-]	• 2nd lambda control closed loop • Cat purge not active • Combustion mode change not active • Engine speed >= 704 RPM • Integrated mass for fuel in oil < 255.00 [-] • Choice of: • O2S rear (binary) check not active • Or • O2S rear (binary) check finished	• 81.0 Sec. • Continuous	• 2 DCY	Check exhaust system for leaks first and correct as necessary. – Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P2097 Post Catalyst Fuel Trim System Too Rich Bank 1	Fuel System Out Of Range High	• adaptation value > 0.05 [-]	• 2nd lambda control closed loop • Cat purge not active • Combustion mode change not active • Engine speed >= 704 RPM • Integrated mass for fuel in oil < 255.00 [-] • Choice of: • O2S rear (binary) check not active • Or • O2S rear (binary) check finished	• 81.0 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2100 Throttle Actuator "A" Control Motor Circuit/Open	Throttle Actuator Open Circuit	• Electronic throttle valve driver load resistance > 200.0 kOhm	• Difference between measured and filtered throttle position <= 119.500° TPS • Actuator commanded off	• 0.1 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P2101 Throttle Actuator "A" Control Motor Circuit Range/Performance	Throttle Actuator Over Temperature	• Electronic throttle valve driver temperature (hardware values) > 170.0 to 190.0° C	• Actuator commanded on	• 0.1 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P2103 Throttle Actuator "A" Control Motor Circuit High	Throttle Actuator Short Circuit	• Electronic throttle valve driver current (hardware values) > 9.3 to 15.0 A	• Actuator commanded on	• 0.1 Sec. • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator Control System - Forced Limited Power	Internal check failed	• Duty cycle > 80% or deviation throttle value angles vs. calculated value > 4 - 50%	• 0.5 - 5 Sec.	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P2122 Throttle/Pedal Position Sensor/Switch "D" Circuit Low	Accelerator Pedal Position Sensor 1 Out Of Range Low	• Signal voltage sensor 1 < 0.39 V		• 0.3 Sec. • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .
P2123 Throttle/Pedal Position Sensor/Switch "D" Circuit High	Accelerator Pedal Position Sensor 1 Out Of Range High	• Signal voltage sensor 1 > 4.86 V		• 0.3 Sec. • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .
P2127 Throttle/Pedal Position Sensor/Switch "E" Circuit Low	Accelerator Pedal Position Sensor 2 Out Of Range Low	• Signal voltage sensor 2 < 0.19 V		• 0.3 Sec. • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2128 Throttle/ Pedal Position Sensor/ Switch "E" Circuit High	Accelerator Pedal Position Sensor 2 Out Of Range High	• Signal voltage sensor 2 > 2.80 V		• 0.3 Sec. • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .
P2138 Throttle/ Pedal Position Sensor/ Switch "D"/"E" Voltage Correlation	Accelerator Pedal Position Sensor 1 and 2 Rationality Check	• Difference between signal voltage sensor 1 and sensor 2 > 0.10 to 0.12 V		• 0.4 Sec. • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .
P2146 Fuel Injector Group A Supply Voltage Circuit Open	Fuel Injector Group "A" Supply Voltage Circuit/Open	• Signal current < 2.6 A Or • Signal current > 14.90 A	• Engine speed > 80 RPM Or • Low side signal current > 2.70 A	• 0.5 Sec.	• 2 DCY	– Check the Fuel Injectors -N30, N31, N32, N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2149 Fuel Injector Group B Supply Voltage Circuit Open	Fuel Injector Group "B" Supply Voltage Circuit/Open	• Signal current < 2.6 A Or • Signal current > 14.90 A	• Engine speed > 80 RPM Or • Low side signal current > 2.70 A	• 0.5 Sec.	• 2 DCY	– Check the Fuel Injectors -N30, N31, N32, N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2177 System too lean off idle, Bank 1	Fuel System System Too Lean @ Part Load	• Adaptive value >= 28.0%	• Air mass > 60.00 mg/stk • ECT @ cylinder block > 55° C • IAT @ manifold > -48° C • AAT > -48° C • Lambda set point 0.92 to 1.05 [-] • Lambda control closed loop • Integrated air mass >= 5.0 to 200.0 [g] • Mass fuel flow 17.99 to 51.02 mg/stk • Engine speed 1,280 to 4,000 RPM • And • Evap purge valve closed • Or • Canister load <= 1.20 [-] • Evap purge flow at max. value • Or • Dependence on canister purge min: • Lower limit of lambda controller output n.a. • Or • Upper limit of lambda controller output n.a. • And • Evap purge flow at min. value	• 5.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking”, page 572 . – Check the intake system for leaks (false air) with a visual inspection. – Check the vacuum lines for leaks with a visual inspection.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2178 System Too Rich Off Idle Bank 1	Fuel System Too Rich @ Part Load	• Adaptive value <= -25.0%	• Air mass > 60.00 mg/stk • ECT @ cylinder block > 55° C • IAT @ manifold > -48° C • AAT > -48° C • Lambda set point 0.92 to 1.05 [-] • Lambda control closed loop • Integrated air mass >= 5.0 to 200.0 [g] • Mass fuel flow 17.99 to 51.02 mg/stk • Engine speed 1,280 to 4,000 RPM • And • Evap purge valve closed • Or • Canister load <= 1.20 [-] • Evap purge flow at max. value • Or • Dependence on canister purge min: • Lower limit of lambda controller output n.a. • Or • Upper limit of lambda controller output n.a. • And • Evap purge flow at min. value	• 5.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking”, page 572 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking”, page 542 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2181 Cooling System Performance	Engine Cooling System Cooling System Performance Not In The Expected Range	• Case 1: • Cooling system temperature too low after a sufficient mass air flow (indication by a mass air flow based temperature model) < 61 to 76° C • Or • Case 2: • Filtered ECT decreases under a threshold value after reaching a high temperature level < 61° C • For time n.a.	• Case 1: • ECT @ first start (lower threshold) >= -10° C • ECT@ first start (upper threshold) <= 42 to 57° C • AAT > -10° C • Start of fault decision: • Modelled ECT > 66 to 76° C • Conditions at fault decision: • Accum. fuel cut off time since first engine start <= 10.20% • Accum. start-stop time since first engine start <= 16.00% • Accum. minimum load and maximum load time since first engine start <= 39.80% • For relative MAF > 40.00% • Or • Relative MAF accum. <= 2.50% • Maximum vehicle speed time since first engine start <= 14.80% • For vehicle speed > 120 km/h • Case 2: • ECT exceeds a threshold value > 65° C • AAT > -10° C • ECT @ first start (lower	• 0 (Unified 430.0) Sec. • Once / DCY	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62- and the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 and ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 . – Check the Coolant Pump -V50-. Refer to the appropriate repair manual. – Check the Coolant Thermostat. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			threshold) >= -40° C • ECT@ first start (upper threshold) <= 215° C • Conditions for time: • Relative MAF > 5.00% • Vehicle speed n.a. • Modeled ECT > 66° C • Engine stop counter < 255.00 [-] • For time >= 15.0 sec.			
P2183 Engine Coolant Temperature Sensor 2 Circuit Range/ Performance	Engine Coolant Temperature Sensor @ Radiator Outlet Cross Check	• Diff. ROT vs. IAT @ first engine start (depending on engine off time) > 20 K • And • Diff. ROT vs. AAT @ first engine start (depending on engine off time) > 20 K • And • Diff. AAT vs. IAT @ first engine start (depending on engine off time) < 20 K	• Engine off time > 360.0 min • Decrement check to ensure an cold vehicle state: • Diff. IAT vs. min. IAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 sec. • Diff. ROT vs. min. ROT @condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 sec. • Diff. AAT vs. min. AAT @condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 sec.	• 100.0 Sec. • Once / DCY	• 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking”, page 539 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2184 Engine Coolant Temperature Sensor 2 Circuit Low	Engine Coolant Temperature Sensor @ Radiator Outlet Short To Ground	• Sensor voltage < 0.30 V		• 0.5 Sec. • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 .
P2185 Engine Coolant Temperature Sensor 2 Circuit High	Engine Coolant Temperature Sensor @ Radiator Outlet Short To Battery / Open Circuit	• Sensor voltage > 4.90 V	• IAT @ throttle >= -33° C • Time after engine start > 60.0 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2187 System Too Lean at Idle Bank 1	Fuel System Too Lean @ Idle	• Case 1: • Adaptive value >= 2.40 mg/stk • Case 2: • Adaptive value >= n.a. kg/h	• Air mass > 60.0 mg/stk • ECT @ cylinder block > 55° C • IAT @ manifold > -48° C • AAT > -48° C • Lambda set point 0.92 to 1.05 [-] • Lambda control closed loop • Integrated air mass >= 5.0 to 200.0 g • Vehicle speed < 6 km/h • Driver request low dynamics • And • Mass fuel flow lower range n.a. • Mass fuel flow upper range < 0.00 to 17.00 mg/stk • Engine speed 704 to 992 RPM • Or • Engine n.a. • And • evap purge valve closed • Or • Canister load <= 1.20 [-] • Evap purge flow at max. value • Or • Depending on canister purge min: • Lower limit of lambda controller output n.a. • Or	• 5.0 Sec. • Continuous	• 2 DCY	– Check the intake system visually for leaks (air not metered through the MAF). – Check the vacuum lines for leaks with a visual inspection. – Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Upper limit of lambda controller output n.a. • And • Evap purge flow at min. value			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2188 System Too Rich at Idle Bank 1	Fuel System Too Rich @ Idle	• Case 1: • Adaptive value <= 2.40 mg/stk • Case 2: • Adaptive value <= n.a. kg/h	• Air mass > 60.0 mg/stk • ECT @ cylinder block > 55° C • IAT @ manifold > -48° C • AAT > -48° C • Lambda set point 0.92 to 1.05 [-] • Lambda control closed loop • Oil dilution not detected • Integrated air mass >= 5.0 to 200.0 g • Vehicle speed < 6 km/h • Driver request low dynamics • And • Mass fuel flow lower range n.a. • Mass fuel flow upper range < 0.00 to 17.00 mg/stk • Engine speed 704 to 992 RPM • Or • Engine n.a. • And • evap purge valve closed • Or • Canister load <= 1.20 [-] • Evap purge flow at max. value • Or • Depending on canister purge min: • Lower limit of lambda controller output n.a. • Or	• 5.0 Sec. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking”, page 551 . – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking”, page 572 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking”, page 542 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Upper limit of lambda controller output n.a. • And • Evap purge flow at min. value			
P2195 O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1	Oxygen Sensors Front Rationality Check	• Plausibility check upstream and downstream oxygen sensor signal: • Lambda value > 1.15 [-] • And • O2S signal rear >= 0.88 V	• O2S front ready • O2S rear ready • ECT @ cylinder block >= -48° C • MAF > 15.0; < 300.0 kg/h • Catalyst purge not active • Integrated MAF after end of catalyst purge 0 [-] • Engine speed > 1,152 RPM • EGT @ O2S front > -273; < 800° C • Combustion mode change not active • Integrated MAF > 40.0 g • Dynamic lambda controller output < 3.50% • Dynamic MAF < 0.08 g/rev • Dynamic engine speed < 200 RPM • And • Case 1: • MAF 0.05 to 0.75 g/rev • Engine speed 576 to 4,512 • Or • Case 2: • Catalyst efficiency diagnosis active	• 72.0 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Open_loop_check: • Lambda set value 1.00 [-] • And • O2S signal front < 1.06 [-]	• Fuel cut off not active • Engine running • And • Choice of: • Fuel trim diagnosis failure detected • Or • O2S rear sensor plausibility failure detected • And • Choice of: • Lambda adaptation value >= 0.12 [-] • Or • Lambda adaptation value <= -0.12 [-]	• 0.0 Sec. • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2196 O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 1	Oxygen Sensors Front Rationality Check	• Plausibility check upstream and downstream oxygen sensor signal: • lambda value < 0.85 [-] • And • O2S signal rear <= 0.25 [V]	• O2S front ready • O2S rear ready • ECT @ cylinder block >= -48° C • MAF > 15.0; < 300.0 kg/h • Catalyst purge not active • Integrated MAF after end of catalyst purge 0 [-] • Engine speed > 1,152 RPM • EGT @ O2S front > -273; < 800° C • Combustion mode change not active • Integrated MAF > 40.0 g • Dynamic lambda controller output < 3.50% • Dynamic MAF < 0.08 g/rev • Dynamic engine speed < 200 RPM • And • Case 1: • MAF 0.05 to 0.75 g/rev • Engine speed 576 to 4,512 • Or • Case 2: • Catalyst efficiency diagnosis active	• 72.0 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• open loop check: • lambda set value 1.00 [-] • And • O2S signal front > 0.89 [-]	• Fuel cut off not active • Engine running • And • Choice of: • Fuel trim diagnosis failure detected • Or • O2S rear sensor plausibility failure detected • And • Choice of: • Lambda adaptation value >= 0.12 [-] • Or • Lambda adaptation value <= -0.12 [-]	• 0.0 Sec. • Continuous		
P2231 O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1	Delta O2S signal front > 190 uA	• Engine speed, < 2,700 RPM • Engine load < 60% • Heater duty cycle, 20 to 80% • Modeled exhaust gas temp < 800.1° C • Lambda 0.95 to 1.05 • Heater control, closed loop, no fault	• 15.0 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2237 O2 Sensor Positive Current Control Circuit Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Pump Voltage (VIP)	• Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 1.20 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) <= 1.20 V • And • Choice of: • Nernst voltage (VN) > 4.40 V • Or • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 2.35 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) < -2.35 V • Or • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.60 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) < -0.10 V • Or • Pump current > 0.0115 A • Or • Measurement WRAF sensor label resistor > n.a. Ohm	• O2S front (linear) ready • Measurement of WRAF sensor label resistor finished • Pump current controller active	• 2.3 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2243 O2 Sensor Reference Voltage Circuit Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Nernst Voltage (VN)	• Diff. pump voltage (VIP) vs. virtual ground voltage (VG) <= 1.20 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.20 V • And • Choice of: • Nernst voltage (VN) > 4.40 V • Or • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 2.35 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) < -2.35 V • Or • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.60 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) < -0.10 V • Or • Pump current > 0.0115 A • Or • Measurement WRAF sensor label resistor > n.a. Ohm	• O2S front (linear) ready • Measurement of WRAF sensor label resistor finished • Pump current controller active	• 2.3 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2251 O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Virtual Ground (VG)	• Nernst voltage (VN) > 4.40 V • Or • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 2.35 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) < -2.35 V • Or • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.60 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) < -0.10 V • Or • Pump current > 0.0115 A • Or • Measurement WRAF sensor label resistor > n.a. Ohm • And • Choice of: • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) <= 1.20 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) <= 1.20 V • Or • Diff. pump voltage (VIP)	• O2S front (linear) ready • Measurement of WRAF sensor label resistor finished • Pump current controller active	• 2.3 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		vs. virtual ground voltage (VG) > 1.20 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.20 V				
P2257 AIR System Control "A" Circuit Low	AIR System Control "A" Circuit Low	• Signal voltage 0 to 3.26 V	• Pump relay commanded off • Engine speed > 80 mph	• 0.5 Sec.	• 2 DCY	– Check the Secondary Air Injection Pump Motor -V101-. Refer to ⇒ S3.6.27 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 577 .
P2258 AIR System Control "A" Circuit High	AIR System Control "A" Circuit High	• Signal current .60 - 2.40 A	• Pump relay commanded on • Engine speed > 80 mph	• 0.5 Sec.	• 2 DCY	– Check the Secondary Air Injection Pump Motor -V101-. Refer to ⇒ S3.6.27 econdary Air Injection Pump Relay J299 / Secondary Air Injection Pump Motor V101, Checking", page 577 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2261 Turbocharger/Supercharger Bypass Valve "A" - Mechanical	Turbocharger Deceleration Bypass Valve Functional Check: Stuck Close	• Case 1: • Integrated boost pressure > n.a. kPa*s • Or • Integrated boost pressure < n.a. kPa*s • Case 2: • Counter for boost pressure deviation > 5.00 [-]	• External torque request not demanded • IAT @ throttle > -11° C • Barometric pressure > 73.0 kPa • Intake overpressure protection not active • Active turbocharger protection leading to opening of the wastegate not active • Activations conditions: • Recirculation actuator position setpoint 100.0% • Time since last valve closed activation > 1,200 ms. • Gradient accelerator pedal value <= -97.70% / sec. • Max boost pressure variation <= 50.0 kPa	• 0.1 Sec. • Continuous	• 2 DCY	– Check the Turbocharger Recirculation Valve -N249-. Refer to ⇒ T3.6.32 urbocharger Recirculation ValveN249, Checking", page 588 .
P2263 Turbocharger/Supercharger Boost System Performance	Turbocharger Boost Control Position Sensor Functional Check	• No adaptation of boost pressure actuator sensor in actual driving cycle (no previous adaptation occured)		• 0.0 Sec. • Once / DCY	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2270 O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 2	Oxygen Sensors Rear Signal Range Check	• Case 1: • Max. O2S rear voltage < 0.87 V • And • Oxygen load during Peak Max detection > 2.6 g • Or • Case 2: • Max. O2S rear voltage < 0.87 V • And • Oxygen load during Peak Max detection > 2.5 g • And • Counter in case of suspected peak max error > 5,000.00 [-]	• General conditions • Vehicle speed >= 10 km/h • Barometric pressure n.a. • Catalyst overheating protection not active • O2S rear ready • O2S front ready • O2S front pump current valid • O2S heater rear active • Integrated heat energy >= 1,600.0 to 3,000.0 kJ • Or • Time after engine start > 230.0 to 1,000.0 sec. • Engine speed 1,280 to 3,008 RPM • Lambda control value < 50.0% • Lambda controller deviation < 0.08 to 0.15 [-] • Quickpass trim control ready • Proportional part of trim control < 0.25 [-] • Lambda adaptation commanded off • Scavenging not active • Valve lift not active • Time after a catalyst purge phase >= 0.02 sec. • Temperature conditions	• 86.5 Sec. • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• ECT > 60° C • IAT > -48° C • Modeled catalyst temp. 500 to 700° C • Modeled catalyst temp. extended range 470 to 730° C • Integrated MAF, catalyst temp. conditions fulfilled > n.a. g • Difference between dynamic and stationary catalyst temp. -254.0 to 254.0 K • Difference between dynamic and stationary catalyst temp. extended range -304.0 to 304.0 K • Modeled catalyst temperature @ start > 550° C • Modeled exhaust gas temperature at O2S rear <= 1,201° C • Air mass flow conditions • MAF per cylinder 40.0 to 130.0 kg/h • MAF per cylinder extended range 35.00 to 135.00 kg/h • MAF 125.01 to 580.0 mg/rev • MAF set point 125.0 to 580.0 mg/rev • MAF extended range n.a. mg/rev • Limited dynamics conditions			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Dynamic engine speed < 20 RPM • Dynamic lambda controller output <= 20.0 % • Dynamic MAF < 25.01 mg/stk • Integrated MAF after dynamic conditions are fulfilled > 20.0 g • Evap purge conditions • Canister load <= 2.00 [-] • Or • evap purge valve closed • Close the gap conditions • O2S rear voltage @ diagnosis start >= 0.55 • Integrated MAF to start diagnosis n.a. • O2S front dynamic diagnosis separate not active			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2271 O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 2	Oxygen Sensors Rear Signal Range Check	• Case 1: • Min. O2S rear voltage > 0.25 V • And • Oxygen load during Peak Min detection > 2.6 g • Or • Case 2: • Min. O2S rear voltage > 0.25 V • And • Oxygen load during Peak Min detection > 2.5 g • And • Counter in case of suspected peak min error > 5,000.00 [-]	• General conditions • Vehicle speed >= 10 km/h • Barometric pressure n.a. • Catalyst overheating protection not active • O2S rear ready • O2S front ready • O2S front pump current valid • O2S heater rear active • Integrated heat energy >= 1,600.0 to 3,000.0 kJ • Or • Time after engine start > 230.0 to 1,000.0 sec. • Engine speed 1,280 to 3,008 RPM • Lambda control value < 50.0% • Lambda controller deviation < 0.08 to 0.15 [-] • Quickpass trim control ready • Proportional part of trim control < 0.25 [-] • Lambda adaptation commanded off • Scavenging not active • Valve lift not active • Time after a catalyst purge phase >= 0.02 sec. • Temperature conditions	• 86.5 Sec. • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• ECT > 60° C • IAT > -48° C • Modeled catalyst temp. 500 to 700° C • Modeled catalyst temp. extended range 470 to 730° C • Integrated MAF, catalyst temp. conditions fulfilled > n.a. g • Difference between dynamic and stationary catalyst temp. -254.0 to 254.0 K • Difference between dynamic and stationary catalyst temp. extended range -304.0 to 304.0 K • Modeled catalyst temperature @ start > 550° C • Modeled exhaust gas temperature at O2S rear <= 1,201° C • Air mass flow conditions • MAF per cylinder 40.0 to 130.0 kg/h • MAF per cylinder extended range 35.00 to 135.00 kg/h • MAF 125.01 to 580.0 mg/rev • MAF set point 125.0 to 580.0 mg/rev • MAF extended range n.a. mg/rev • Limited dynamics conditions			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Dynamic engine speed < 20 RPM • Dynamic lambda controller output <= 20.0 % • Dynamic MAF < 25.01 mg/stk • Integrated MAF after dynamic conditions are fulfilled > 20.0 g • Evap purge conditions • Canister load <= 2.00 [-] • Or • evap purge valve closed • Close the gap conditions • O2S rear voltage @ diagnosis start >= 0.55 • Integrated MAF to start diagnosis n.a. • O2S front dynamic diagnosis separate not active			
P2274 O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 3	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 3	• Sensor voltage of <= 0.70 V • O2S rear signal not oscillating at reference < 0.62 to 0.65 V • Enrichment after stuck lean 27.9%	• Mass air flow 25 to 150 kg/h • O2S rear readiness > 30 sec. • Modeled exhaust gas temp > 350° C • 2nd lambda control closed loop	• 215 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2275 O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 3	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 3	• O2S sensor voltage >= 0.15 V • After oxygen mass flow (fuel cutoff) > 4,500 mg • Number of checks >= 1	• Time of fuel cut-off <= 90 Sec. • Time after last fuel cutoff >= 20 sec. • O2S rear ready • Exhaust temp at sensor >= 385° C • Exhaust mass flow > 12 kg/h • Exhaust mass flow dynamic within range -80 to 80 kg/h • Sensor voltage at start of measurement > 0.45 V	• 10 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P2279 MAP /MAF - Throttle Position Correlation	Intake Air System Rationality Check	• Ratio adapted turbocharger boost pressure and actual turbocharger boost pressure > 30.0% • Lambda correction included controller and adaptation -50.0 to 50.0% • Lambda controller active	• Intake manifold modeled adaptation active (by turbocharger boost pressure) • Throttle position > 4.50° TPS • Engine speed 1,216 to 6,000 RPM • Pressure quotient @ throttle 0.63 to 0.90 [-] • Engine running • Fast throttle adaptation finished • MAP gradient -200.0 to 200.0 kPa/sec. • Fuel cut off not active • Time after engine start > 5.0 sec. • Boost pressure < 135.0 kPa] • BARO 73.00 to 107.50 kPa	• 5.0 Sec. • Continuous	• 2 DCY	Check for air leaks between MAF and throttle body, oil fill cap not tight or oil dipstick not seated in tube. Also any engine gaskets that can cause additional air to enter the crankcase can set this fault as the PCV system is not metered. If a vacuum leak or crankcase gasket sealing is at cause, the idle may be rough or unstable.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Throttle cross-sectional area correction included controller and adaptation > 50.0% • Lambda correction included controller and adaptation -28.0 to 28.0% • Lambda controller active	• Intake manifold modeled adaptation active (by turbocharger boost pressure) • Throttle position 0.000 to 100.003° TPS • Engine speed 576 to 3,008 RPM • Pressure quotient @ throttle 0.27 to 0.60 [-] • Fast throttle adaptation finished • MAP gradient -200.0 to 200.0 kPa/sec. • Fuel cut off not active • Time after engine start > 5.0 sec. • Boost pressure 73.00 to 107.50 kPa • BARO 73.00 to 107.50 kPa			
P2293 Fuel Pressure Regulator 2 Performance	Fuel Pressure Regulator 2 Performance	• Difference between target pressure vs actual pressure: > 1.50 MPa • Or • < -1.50 MPa	• Time after engine start 10 Sec. • Fuel cutoff not active	• 3.0 Sec.	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .
P2294 Fuel Pressure Regulator 1 Control Circuit/ Open	Fuel Pressure Regulator 1 Control Circuit/ Open	• Signal voltage 1.40 - 3.20 V • Or • Signal pattern incorrect	• Fuel control valve commanded Off • Fuel pump commanded On	• 0.5 Sec.	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2295 Fuel Pressure Regulator 2 Control Circuit Low	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage 1.40 - 3.20 V	• Fuel control valve commanded Off	• 0.5 Sec.	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .
P2296 Fuel Pressure Regulator 2 Control Circuit High	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V	• Fuel control valve commanded On	• 0.5 Sec.	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .
P2300 Ignition Coil A Primary Control Circuit Low	Ignition Coils Short To Ground	• Output current in ON state (hardware values) > 50 to 100 mA	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2301 Ignition Coil A Primary Control Circuit High	Ignition Coils Short To Battery Plus	• Diagnosis_by_inactive_low side switch in ATIC: • Output voltage in OFF state (hardware values) > 4.95 to 5.285 V	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded off	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diagnosis_by_inactive_low side switch in ATIC: • Output temperature from ATIC in ON state > 160.0 to 200.0° C • Or • Output current in ON state (hardware values) > 100.0 to 180.0 mA				
P2302 Ignition Coil "A" Secondary Circuit	Ignition Coils Open Circuit	• Output voltage in OFF state lower range >= 1.92 to 2.21 V • Output voltage in OFF state upper range (hardware values) <= 2.85 to 3.25 V •	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2303 Ignition Coil B Primary Control Circuit Low	Ignition Coils Short To Ground	• Output current in ON state (hardware values) > 50 to 100 mA	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N127-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2304 Ignition Coil B Primary Control Circuit High	Ignition Coils Short To Battery Plus	• Diagnosis_by_inactive_low side switch in ATIC: • Output voltage in OFF state (hardware values) > 4.95 to 5.285 V	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded off	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N127-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage ,

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diagnosis_by_inactive_low side switch in AT-IC: • Output temperature from ATIC in ON state > 160.0 to 200.0° C • Or • Output current in ON state (hardware values) > 100.0 to 180.0 mA				Checking", page 553 .
P2305 Ignition Coil "B" Secondary Circuit	Ignition Coils Open Circuit	• Output voltage in OFF state lower range >= 1.92 to 2.21 V • Output voltage in OFF state upper range (hardware values) <= 2.85 to 3.25 V •	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N127-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2306 Ignition Coil C Primary Control Circuit Low	Ignition Coils Short To Ground	• Output current in ON state (hardware values) > 50 to 100 mA	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N291-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2307 Ignition Coil C Primary Control Circuit High	Ignition Coils Short To Battery Plus	• Diagnosis_by_inactive_low side switch in AT-IC: • Output voltage in OFF state (hardware values) > 4.95 to 5.285 V	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded off	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N291-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage ,

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diagnosis_by_inactive_low side switch in ATIC: • Output temperature from ATIC in ON state > 160.0 to 200.0° C • Or • Output current in ON state (hardware values) > 100.0 to 180.0 mA				Checking", page 553 .
P2308 Ignition Coil "C" Secondary Circuit	Ignition Coils Open Circuit	• Output voltage in OFF state lower range >= 1.92 to 2.21 V • Output voltage in OFF state upper range (hardware values) <= 2.85 to 3.25 V •	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N291-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2309 Ignition Coil D Primary Control Circuit Low	Ignition Coils Short To Ground	• Output current in ON state (hardware values) > 50 to 100 mA	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2310 Ignition Coil D Primary Control Circuit High	Ignition Coils Short To Battery Plus	• Diagnosis_by_inactive_low side switch in ATIC: • Output voltage in OFF state (hardware values) > 4.95 to 5.285 V	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded off	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage ,

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diagnosis_by_inactive_low side switch in ATIC: • Output temperature from ATIC in ON state > 160.0 to 200.0° C • Or • Output current in ON state (hardware values) > 100.0 to 180.0 mA				Checking", page 553 .
P2311 Ignition Coil "D" Secondary Circuit	Ignition Coils Open Circuit	• Output voltage in OFF state lower range >= 1.92 to 2.21 V • Output voltage in OFF state upper range (hardware values) <= 2.85 to 3.25 V •	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 Sec. • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P240A EVAP System Leak Detection Pump Heater Control Circuit/Open	EVAP Leak Detection Pump Heater Open Circuit	• Output voltage lower range 1.85 to 2.28 V • Output voltage upper range (hardware values) 2.75 to 3.36 V	• Actuator commanded off	• 0.3 Sec • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P240B EVAP System Leak Detection Pump Heater Control Circuit Low	EVAP Leak Detection Pump Heater Short To Ground	• Output voltage (hardware values) < 1.85 to 2.28 V	• Actuator commanded off	• 0.3 Sec • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P240C EVAP System Leak Detection Pump Heater Control Circuit High	EVAP Leak Detection Pump Heater Short To Battery Plus	• Actuator temperature > 155 to 185° C • Or • Output current (hardware values) > 1.0 to 3.0 A	• Actuator commanded ON	• 0.3 Sec • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P2400 Evaporative Emission System Leak Detection Pump Control Circuit Open	Leak Detection Pump Open Circuit	• Output voltage (hardware values) 1.85 to 2.28 V	• Actuator commanded off	• 2.0 Sec • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2401 Evaporative Emission System Leak Detection Pump Control Circuit Low	Leak Detection Pump Short To Ground	• Output voltage (hardware values) < 1.85 to 2.28 V	• Actuator commanded off	• 2.0 Sec • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P2402 Evaporative Emission System Leak Detection Pump Control Circuit High	Leak Detection Pump Short To Battery Plus	• Actuator temperature > 155 to 185° C • Or • Output current (hardware values) > 1.0 to 3.0 A	• Actuator commanded ON	• 2.0 Sec • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2403 Evaporative Emission System Leak Detection Pump Sense Circuit Open	EVAP System Leak Detection Pump Sense Circuit/Open	Low signal voltage > 0.5 Sec.	• Time after engine start 5.0 - 65,530 • ECT 5 - 120° C • ECT at start 5 - 50° C • Engine off time > 21,600 • Altitude < 2,700 m • Integrated purge flow > 12 g • Restart temp diff > 0° K • Veh speed >= 0 km/h • Veh speed ones > 30 km/h • Any drive gear • EVAP purge valve ready no faults • LDP commanded off	• 0.5 Sec. • Once / DCY	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2404 EVAP System Leak Detection Pump Sense Circuit Range/Performance	EVAP System Leak Detection Pump Sense Circuit Range/Performance	• High signal voltage > 12 Sec. • Number of checks = 30	• Time after engine start 12 - 65,530 • Engine off time > 21,600 • ECT 5 - 120° C • ECT at start 5 - 50° C • Ambient air temp 5 - 59° C • Altitude < 2,700 m • Intake manifold vacuum > -2,560 hPa • Restart temp diff > 0° K • Veh speed >= 0 km/h • Veh speed ones > 30 km/h • Any drive gear • EVAP purge valve ready no faults • LDP commanded off	• 12 to 143 Sec. • Once / DCY	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking”, page 563 .
P2407 Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic	EVAP System Signal Check	• Pump current oscillation > 1.5 mA • And • Number of aborted leak measurements due to pump current oscillations > 0.00 [-]	• Time after measurement start (during ECM keep alive-time) > 4.0 sec.	• 624.0 Sec. • Once / DCY	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking”, page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2414 O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	Oxygen Sensors Front Rationality Check	• Pump current correction (nernst-cell) > 1.2 mA	• O2S front ready • Fuel cut off not active • Cylinder shut off not active • Combustion mode change not active • Depending on engine state: • Engine part load • Or • Engine full load • Or • Engine idle • For time >= 3.0 sec.	• 10.0 Sec. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P2431 AIR System Air Flow/ Pressure Sensor Circuit Range/ Performance Bank 1	AIR System Air Flow/ Pressure Sensor Circuit Range/ Performance Bank 1	• Difference between SAI pressure sensor and ambient pressure NOT -60.0 to 60.0 hPa	SAI completed	• 0.5 Sec.	• 2 DCY	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2432 AIR System Air Flow/ Pressure Sensor Circuit Low Bank 1	AIR System Air Flow/ Pressure Sensor Circuit Low Bank 1	• Signal voltage < 0.40 V		• 0.5 Sec.	• Continuous • 2 DCY	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .
P2433 AIR System Air Flow/ Pressure Sensor Circuit High Bank 1	AIR System Air Flow/ Pressure Sensor Circuit High Bank 1	• Signal voltage > 4.65 V		• 0.5 Sec.	• Continuous • 2 DCY	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2440 AIR System Switching Valve Stuck Open Bank 1	AIR System Switching Valve Stuck Open Bank 1	• SAI pressure sensor vs modeled while SAI valve is closed < 71.1%	• ECT 5.3 - 50.3° C • IAT 5.3 - 60° C • Altitude < 2,700 m • SAI press sensor ready, no fault	• 43.5 Sec.	• 2 DCY	– Check the Secondary Air System -GX24-. For Passat, refer to ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)", page 580 . For all others, refer to ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)", page 581 .
P2450 Evaporative Emission System Switching Valve Performance/ Stuck Open	EVAP System Rationality Check	• Time after measurement start > 2.0; < 2.5 sec. • And • Drop of evap pump current < 3.0 mA	• Barometric pressure > 73.00 kPa • AAT 4 to 38° C • ECT @ start >= 4° C • Time since engine start in preceding DCY >= 600.0 sec. • Difference between ECT and AAT @ start <= 20.3 K • Engine stop (during ECM keep alive-time) air bag not activated	• 0.5 Sec. • Once / DCY	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2563 Turbocharger Boost Control Position Sensor "A" Circuit Range/ Performance	Turbocharger Boost Control Position Sensor Functional Check Functional Check	• Boost pressure actuator sensor voltage > 4.52; < 2.73 V	• Gradient of boost pressure >= -2.98% / sec.	• 0.3 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .
P2564 Turbocharger Boost Control Position Sensor "A" Circuit Low	Turbocharger Boost Control Position Sensor Short To Ground / Open Circuit	• Turbocharger boost control position sensor voltage < 0.20 V		• 0.1 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2565 Turbocharger Boost Control Position Sensor "A" Circuit High	Turbocharger Boost Control Position Sensor Short To Battery Plus	• Turbocharger boost control position sensor voltage > 4.80 V		• 0.1 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor - G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .
P2610 ECM /PCM Engine Off Timer Performance	Engine Off Time Rationality Check	• Difference between engine-off-time and ECM keep alive-time > 12.0 sec. • Or • Engine off time (hardware values) not valid	• General: • SPI communication finished • ECM internal time valid • Choice of: • ECM keep alive time active • ECM internal timer reset not activated • Time delay >= 1.0 sec. • Or • Delay timer for acquisition of engine off time (hardware values) > 1.0 sec. • Or • Result of low power check initialization > 0.0; < 9.0 [-]	• 0.01 Sec. • Once / DCY	• 2 DCY	– Replace the Engine Control Module - J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Difference between engine-off-time and ECM keep alive-time >= 12.0 sec.	• Time after engine stop < 86,400.0 sec. • Engine off time plausible • Engine off time monitoring not finished • Engine off time signal valid • Time after reset < 2.0 sec. • And • Case 1: • Engine off timer n.a. • Or • Engine off time n.a. • Case 2: • ECM internal timer active • SPI communication failure after reset detected			
	Engine Off Time ECM Internal Timer Check	• ECM internal timer initialisation failure • Or • ECM internal timer communication failure	• ECM internal timer reset not active • SPI communication failure after reset not detected	• 1.3 Sec. • Continuous	• 2 DCY	
P2626 O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	• O2S signal front > 4.81 V	• Modeled exhaust temp < 700° C • O2S ceramic temp > 715° C • Fuel cut off active • Heater control closed loop • No low fuel signal	• 1.5 Sec.	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P3081 Engine Temperature Too Low	Engine Temperature Too Low	Cooling system temperature < 74° C - 84° C after AAT check		• 4.0 Sec.	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62- and the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 and ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 . – Check the engine coolant thermostat. Refer to the appropriate repair manual.
P334A Charge Pressure Actuator Electrical Error	Turbocharger Boost Pressure Control Valve Short Circuit	• Bypass valve driver current (hardware values) > 9.3 to 15.0 A	• Boost pressure actuator controller active	• 0.4 Sec. • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0001 High Speed CAN Communication Bus	CAN: Powertrain BUS Reading Back Sent Message Powertrain	• Message no feedback	• Time after ignition on 0.5 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0002 High Speed CAN Communication Bus Performance	CAN: Global Time Out CAN Communication	• General CAN timeout >= 0.4 sec.	• Time after ignition on >= 0.5 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0101 Lost Communication with TCM	CAN: Transmission Control Module (TCM) CAN Communication With TCM	• Received CAN message no message	• Time after ignition on >= 0.5 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0121 Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN: Brake System Control Module (BSCM) CAN Communication With Brake Unit	• Received CAN message no message	• Time after ignition on >= 0.5 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0140 Lost Communication With Body Control Module	CAN: Body Control Module (BCM) CAN Communication With Body Control Module	• Received CAN message no message	• Time after ignition on >= 0.5 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0146 Lost Communication With Gateway A	CAN: Gateway CAN Communication With Gateway	• Received CAN message no message	• Time after ignition on >= 0.5 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0155 Lost Communication With Instrument Panel Cluster (IPC) Control Module	CAN: Instrument Cluster CAN Communication With Instrument Cluster Module	• Received CAN message no message	• Time after ignition on >= 0.5 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0302 Software Incompatibility with Transmission Control Module	ECM: Coding Code Check Of ECM Concerning TCM	• Received AT vehicle data from TCM, TCM signal		• 50.0 Sec. • Continuous	• 2 DCY	– Check for software updates and TSB's. Reprogram as necessary. If none are found, replace the DSG Transmission Mechatronic -J743-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0323 Software Incompatibility With Instrument Panel Control Module	CAN: Ambient Air Temperature Sensor Communication With Instrument Cluster Module	• Ambient temperature sensor: source configuration failure	• Time after ignition on > 1.2 sec.	• 1.0 Sec. • Continuous	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 .
U0402 Invalid Data Received From TCM	CAN: Transmission Control Module (TCM) CAN Communication With TCM	• Received data from TCS, implausible message	• Time after ignition on >= 0.5 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check for software updates and TSB's. Reprogram as necessary. If none are found, replace the DSG Transmission Mechatronic -J743-. Refer to the appropriate repair manual.
U0415 Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	CAN: Vehicle Speed Sensor CAN Communication With Vehicle Speed Sensor	• Speed sensor signal: sensor error 327.42 km/h • Speed sensor signal: initialisation error 327.08 km/h • Speed sensor signal: low voltage error 327.25 km/h	• Time after ignition on > 500 ms.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Speed sensor signal: range error 326.40 to 327.07 km/h • Or • Speed sensor signal: range error 327.09 to 327.24 km/h • Or • Speed sensor signal: range error 327.26 to 327.41 km/h • Or • Speed sensor signal: range error 327.43 to 327.67 km/h				
	CAN: Brake System Control Module (BSCM) CAN Communication With Brake Unit	• Received data from TCS implausible message	• Time after ignition on >= 0.5 sec.			
	Vehicle Speed Rationality Check High	• Vehicle speed > 325 km/h		• 2.0 Sec. • Continuous	• 2 DCY	
U0422 Invalid Data Received From Body Control Module (IPC)	Invalid Data Received From Body Control Module	Ambient temperature value initialization failure.	• Status ambient temperature from instrument cluster no fault • Electrical check ambient temperature sensor no fault	• 2.0 Sec.	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 If no fault is found, replace the Instrument Panel Cluster (IPC). Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0423 Invalid Data Received From Instrument Panel Cluster Control Module	CAN: Ambient Air Temperature Sensor CAN Communication With Ambient Air Temperature Sensor	• Ambient air temperature signal failure	• Time after ignition on > 0.5 sec. • Engine running	• 0.6 Sec. • Continuous	• 2 DCY	– Check the Outside Air Temperature Sensor - G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 .
	CAN: Ambient Air Temperature Sensor Communication With Instrument Cluster Module	• Ambient temperature sensor: source in reset failure	• Time after ignition on > 1.2 sec.	• 2.0 Sec. • Continuous		
	CAN: Instrument Cluster CAN Communication With Instrument Cluster Module	• Received data from Instrument Cluster implausible message	• Time after ignition on > 0.5 sec.	• 0.5 Sec. • Continuous		
U0447 Invalid Data Received From Gateway "A"	CAN: Gateway CAN Communication With Gateway	• Received data from Gateway implausible message	• Time after ignition on >= 0.5 sec.	• 0.5 Sec. • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U1103 Production mode active	ECM: Production Mode Function Monitoring: Mode Change	• Production mode active	• Vehicle speed < 5 km/h • Max trip mileage since initial vehicle start-up < 100 km • During ECM keep alive-time after ignition off • Engine speed 0 RPM • For hybrid: drive motor off	• 0.01 Sec. • Continuous	• 1 DCY	– Vehicle in production mode. Refer to appropriate repair manual for resolution.

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P000A "A" Camshaft Position Slow Response Bank 1	Variable Valve Timing (VVT) Intake Actuator Rationality Check	• Adjustment angle difference >= 3.00 < 15.00° CRK	• Modeled oil temperature -40 – 160° C • Engine speed 608 – 6,016 RPM • Set point change > 29.00° CRK • Camshaft position n.a. • Dynamic diagnosis timer >= 0.95 – 4.00 s	• 0 (FTP75: 300.0) s • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .
P0010 "A" Camshaft Position Actuator Control Circuit/Open Bank 1	Variable Valve Timing (VVT) Intake Actuator Open Circuit	• Output voltage, lower range 1.92 – 2.21 V • Output voltage, upper range (hardware values) 2.85 – 3.25 V	• Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .
P0011 "A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	Variable Valve Timing (VVT) Intake Actuator Rationality Check	• Camshaft position deviation > 10.0° CRK	• Modeled oil temperature -40 – 160° C • Engine speed 608 – 6,016 RPM • Camshaft position n.a. • Camshaft position adjustment active • Catalyst heating n.a. • Camshaft position deviation integrator (actual vs. setpoint position) >= 9.00 – 12.00° CRK's	• 0 (FTP75: 250.0) s • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0016 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Camshaft Position/ Crankshaft Position Intake - Adaptation Value Monitoring	• Adapted value for each edge of the target wheel < -14.00° CRK Or • Adapted value for each edge of the target wheel > 14.00° CRK	• Camshaft position adaptation active • (Exhaust side) • Engine speed 288 – 4,000 RPM • Modeled oil temperature >= -15° C • Modeled oil temperature <= 160° C • Diff. actual exhaust camshaft position vs. previous camshaft position @ reference signal edge < 2.00° CRK • Case 1: • Ignition off • Engine speed > 380 RPM • Engine stalling >= 1.0 s • Or • Case 2: • Engine speed >= 380 RPM • Engine running • Engine stalling >= 5.0 s • Case 3: • Backwards rotation not detected • Case 4: • Engine speed >= 400 RPM • Engine stopped	• 720.0° CRK • Multiple	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 . – Check the Engine Speed Sensor -G28-. Refer to ⇒ E3.6.10 ngine Speed Sensor G28, Checking", page 540 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0030 HO2S Heater Control Circuit Bank 1 Sensor 1	Oxygen Sensors Heater Front Open Circuit	• O2S front heater voltage, lower range 1.92 – 2.21 V • O2S front heater voltage, upper range 2.85 – 3.25 V		• 2.5 s. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0031 HO2S Heater Control Circuit Low Bank 1 Sensor 1	Oxygen Sensors Heater Front Short To Ground	• O2S front heater voltage < 1.92 – 2.21 V		• 2.5 s. • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0032 HO2S Heater Control Circuit High Bank 1 Sensor 1	Oxygen Sensors Heater Front Short To Battery Plus	• O2S front heater driver temperature > 160.0 – 200.0° C • O2S upstream heater driver output current driver stage internal value	• Modeled EGT @ O2S front >= -273° C • Actuator commanded on	• 2.5 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0033 Turbocharger/Supercharger Bypass	Turbocharger Bypass (TCBY) Open Circuit	• Voltage, lower range 1.92 – 2.21 V • Voltage, upper range (hardware values) 2.85 – 3.25 V	• Actuator commanded off	• 1.0 s • Continuous	• 2 DCY	– Check the Turbocharger Recirculation Valve -N249-. Refer to ⇒ T3.6.32 urbocharger Recirculation ValveN249,

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
Valve "A" Control Circuit	Turbocharger Bypass (TCBY) Short To Battery Plus	• Current driver stage internal value • Or • Temperature (hardware values) > 160 – 200° C	• Actuator commanded on	• 1.0 s • Continuous	• 2 DCY	Checking", page 588 .
P0034 Turbocharger/Supercharger Bypass Valve "A" Control Circuit Low	Turbocharger Bypass (TCBY) Short To Ground	• Voltage (hardware values) < 1.92 – 2.21 V	• Actuator commanded off	• 1.0 s • Continuous	• 2 DCY	– Check the Turbocharger Recirculation Valve -N249-. Refer to ⇒ T3.6.32 urbocharger Recirculation ValveN249, Checking", page 588 .
P0036 HO2S Heater Control Circuit Bank 1 Sensor 2	Oxygen Sensors Heater Rear Open Circuit	• O2S rear heater voltage, lower range 1.92 – 2.21 V • O2S downstream heater voltage, upper range 2.85 – 3.25 V	• Engine not in start process	• 2.5 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0037 HO2S Heater Control Circuit Low Bank 1 Sensor 2	Oxygen Sensors Heater Rear Short To Ground	• O2S rear heater voltage < 1.92 – 2.21 V	• Engine not in start process	• 2.5 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0038 HO2S Heater Control Circuit High Bank 1 Sensor 2	Oxygen Sensors Heater Rear Short To Battery Plus	• O2S rear heater driver temperature > 160.0 – 200.0° C • Or • O2S rear heater driver output current driver stage internal value	• EGT @ O2S rear (binary) >= 300° C • Actuator commanded on • Engine not in start process	• 2.5 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0045 Turbocharger/Supercharger Boost Control "A" Circuit/Open	Turbocharger Boost Pressure Control Valve Open Circuit	• Bypass valve driver load resistance > 200 kOhm	• Deviation between actual and filtered boost pressure actuator position <= 5.0% • Boost pressure actuator controller not active • Time delay > 1.0 s	• 0.4 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor - G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .
P0049 Turbocharger/Supercharger "A" Turbine Overspeed	Turbocharger (TC) Boost Pressure Control Out Of Range High	• Turbocharger speed >= 240,002 RPM • Or • IAT @ throttle >= 336° C • For time >= 6.0 s	• Engine running	• 2.6 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor - G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0068 MAF vs Throttle Position Correlation	Manifold Absolute Pressure (MAP) Sensor Large Leakage Detection	• Diff. MAP setpoint vs. actual MAP < -15.00 – -10.00 kPa	• Fast throttle adaptation finished • MAP gradient -200.00 – 200.00 kPa/sec. • Vehicle speed <= 2 km/h • Time after engine start > 5.0 s • Engine speed, lower range > 576 RPM • Engine speed, upper range < 3,000 RPM • IAT @ manifold > -48° C • ECT @ cylinder block > -48° C • Pressure quotient @ throttle 0.10 – 0.60 [-] • Load dynamic conditions: • Dynamic engine speed < 8,160 RPM • Dynamic air mass < 25.01 mg/rev	• 5.0 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Intake Air System Rationality Check	• Throttle opening area correction included controller and adaptation < -60.0% • Lambda correction included controller and adaptation -28.0 – 28.0% • Lambda controller active	• Intake manifold modeled adaptation active (by throttle opening area) • Throttle position 0.0 – 100.003° TPS • Engine speed 576 – 3,008 RPM • Pressure quotient @ throttle 0.27 – 0.60 [-] • Fast throttle adaptation finished • MAP gradient -200.0 – 200.0 kPa/sec. • Fuel cut off not active • Time after engine start > 5.0 s • Turbocharger boost pressure 135 kPa • BARO 73.0 – 107.50 kPa			
P0070 Ambient Air Temperature Sensor Circuit "A"	COM: Ambient Air Temperature (AAT) Sensor Short To Battery / Open Circuit	• AAT sensor voltage (hardware values) > 4.50 V		• 2.0 s. • Continuous	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0071 Ambient Air Temperature Sensor Circuit "A" Range/Performance	Ambient Air Temperature Sensor Cross Check	• Diff. AAT vs IAT @ first engine start (depending on engine off time) > 20 K And • Diff. AAT vs ROT @ first engine start (depending on engine off time) > 20 K And • Diff. IAT vs. ROT @ first engine start (depending on engine off time) < 20 K	• Engine off time > 360.0 min. • Decrement check to ensure a cold vehicle state: • Diff. IAT vs. min. IAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 s and diff. ROT vs. min. ROT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 s • Diff. AAT vs. min. AAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 s	• 100.0 s • Once / DCY	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 .
P0072 Ambient Air Temperature Sensor Circuit "A" Low	COM: Ambient Air Temperature (AAT) Sensor Short To Ground	• AAT sensor voltage (hardware values) < 0.10 V		• 2.0 s • Continuous	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel Rail Pressure (FRP) Out Of Range Low	• Deviation between reference fuel pressure set point and current fuel pressure > 2,000.10 kPa • Case: 1 • Fuel mass controller output -50.00 – 50.00% • High pressure controller output > 30 mg • Fuel pressure < 2,500.00 kPa • Case 2: • Fuel pump at max limit • Mass fuel flow set point n.a. • Fuel pressure n.a.	• Engine speed 608 – 6,816 RPM • Mass fuel flow set point 15.01 – 1,389.00 mg/rev • Time after engine start > 5.0 s • Engine warm-up n.a. • Catalyst heating n.a. • Full load n.a. • Catalyst purge n.a. • Lambda control n.a. • Evap purge functionality diagnosis n.a. • Depending on low dynamic conditions: • Fuel mass setpoint lower range > 1.99 mg/rev • For time >= 5.0 s • Fuel mass setpoint upper range < 100.32 – 172.41 mg/rev • Fuel mass setpoint gradient -1389.00 – 2.20 [mg/rev] • For time >= 1.2 s • Depending on canister purge: • Canister load not calibrated • Evap purge valve not calibrated	• 2.0 s • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking”, page 551 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Rail Pressure (FRP) Rationality Check Low	• Fuel mass controller output -50.00 – 50.00% • And • High pressure controller output > 35 mg • Deviation between fuel pressure set point and current fuel pressure > 2,000.10 kPa • And • Fuel pressure >= 2,500.00 kPa	• Engine speed 608 – 6,816 RPM • Mass fuel flow set point 15.01 – 1,389.00 mg/rev • For time after request for mass fuel flow set point >= 5.0 s • Time after engine start > 5.0 s • Engine warm-up n.a. • Catalyst heating n.a. • Full load n.a. • Catalyst purge n.a. • Lambda control n.a. • Evap purge functionality diagnosis n.a. • depending on low dynamic conditions: • Fuel mass setpoint lower range > 1.99 mg/rev • For time >= 5.0 s • Fuel mass setpoint upper range < 100.32...172.41 mg/rev • Fuel mass setpoint gradient -1389.00 – 2.20 mg/rev • For time >= 1.2 s • Depending on canister purge: • Canister load not calibrated • Evap purge valve not calibrated	• 5.0 s • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0088 Fuel Rail/ System Pressure - Too High Bank 1	Fuel Rail Pressure (FRP) out of range high	• Deviation between fuel pressure setpoint and current fuel pressure < -2000.10 kPa • Deviation lambda of controller included adaptation -50.00 – 50.00 % • Case 1: • High pressure controller output < -30 mg • Case 2: • Flow control valve open • Mass fuel flow setpoint > 15.01 mg/rev	• Engine speed 608 – 6,816 RPM • Mass fuel flow set point 15.01 – 1,389.00 mg/rev • Time after engine start > 5.0 s • Engine warm-up n.a. • Catalyst heating n.a. • Full load n.a. • Catalyst purge n.a. • Lambda control n.a. • Evap purge functionality diagnosis n.a. • Depending on low dynamic conditions: • fuel mass setpoint lower range > 1.99 mg/rev • For time >= 5.0 s • Fuel mass setpoint upper range < 100.32 – 172.41 mg/rev • fuel mass setpoint gradient -1389.00 – 2.20 mg/rev • For time >= 1.2 s • Depending on canister purge: • Canister load not calibrated • Evap purge valve not calibrated	• 5.0 s • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 .
P0090 Fuel Pressure Regulator 1 Control	Fuel Volume Regulator Control Open Circuit	• Voltage high side < 1.87 – 2.26 V • Voltage low side > 2.78 – 3.33 V	• Engine speed 0 RPM • Or • Fuel cut off active • Actuator commanded off	• 0.2 s • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
Circuit/ Open		• Low and high side off: • Voltage low side > 2.78 – 3.33 V • Voltage high side < 1.87 – 2.26 V • Low and high side on: • Current low side driver stage internal value • Current high side driver stage internal value	• Engine speed > 600 RPM • Fuel cut off not active • Actuator commanded on			Valve N276, Checking", page 549 .
P0091 Fuel Pressure Regulator 1 Control Circuit Low	Fuel Volume Regulator Control Short To Ground (High Side)	• Current high side (hardware values) driver stage internal value •	• Ignition on • Or • Ignition off (during ECM keep alive-time) • And • Actuator commanded on	• 0.2 s • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .
	Fuel Volume Regulator Control Short To Ground (Low Side)	• Voltage low side (hardware values) < 1.87 – 2.26 V	• Ignition on • Or • Ignition off (during ECM keep alive-time) • And • Actuator commanded off			
P0092 Fuel Pressure Regulator 1 Control Circuit High	Fuel Volume Regulator Control Short To Battery Plus (Low Side)	• Current low side (hardware values) driver stage internal value •	• Ignition on • Or • Ignition off (during ECM keep alive-time) • And • Actuator commanded on	• 0.2 s • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Volume Regulator Control Short To Battery Plus (High Side)	• Voltage high side (hardware values) < 2.78 – 3.33 V	• Ignition on • Or • Ignition off (during ECM keep alive-time) • And • Actuator commanded off			
P00AF Turbocharger/Supercharger Boost Control "A" Module Performance	Turbocharger Boost Pressure Control Valve Functional Check - Transient Check	• Boost pressure actuator position controller output > 98.0%	• Time after engine start >= 4.0 s • ECT > -40° C • AAT > -40° C • Catalyst heating not active • Boost pressure control active	• 0.4 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor - G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .
		• Boost pressure actuator position controller output < -98.0%				
	Turbocharger Boost Pressure Control Valve Functional Check	• Deviation boost pressure actuator position controller > 16.00 – 100.0%				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0106 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Range/Performance	Manifold Pressure Sensor Cross Check	• Case 1: Charged engine • Diff. BARO vs. MAP > 7.50 kPa • Diff. turbocharger boost pressure vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure <= 7.50 kPa • Case 2: Non charged engine • Diff. BARO mean value vs. MAP mean value >= n.a. kPa • Diff. deviation BARO mean value to mean value (MAP mean value, BARO mean value, BARO @ ECM keep alive time and MAP @ ECM keep alive time) <= n.a. kPa • Diff. deviation MAP mean value to mean value (MAP mean value, BARO mean value, BARO @ ECM keep alive time and MAP @ ECM keep alive time) > n.a. kPa • Diff. BARO mean value @ ECM keep alive	• Case A: engine stop during DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a. • For time >= 10.0 s • Case B: Engine stop @ start of DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a.	• 3.0 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 . If there is no fault found with the Charge Air Pressure sensor or wiring, check for any related TSB's. The Altitude (Baro) sensor is located within the ECM and will require replacement of the ECM if faulty. Check the Baro reading with a scan tool vs. actual Baro for the area. If Baro is off by more than 10%, replace the ECM. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		vs. MAP mean value @ ECM keep alive time > n.a. kPa • Diff. BARO mean value vs. MAP mean value > n.a. kPa				
		• Case 1: Charged engine • Diff. BARO vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure <= 7.50 kPa • Diff. turbocharger boost pressure vs. MAP > 7.50 kPa • Case 2: Non charged engine • Diff. BARO mean value @ ECM keep alive vs. MAP mean value @ ECM keep alive time > n.a. kPa	• Engine stopped • Vehicle speed < 1 km/h • ECM keep alive time 10.0 – 6,553.5 s • Time after engine stop >= 5.0 s • BARO sensor voltage 0.20 – 4.80 V • MAP sensor voltage 0.20 – 4.80 V • Boost pressure sensor voltage 0.20 – 4.80 V			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Intake Air System Rationality Check	• Throttle opening area correction included controller and adaptation > 40.00% • Lambda correction included controller and adaptation < -28.00%	• Intake manifold modeled adaptation active • Throttle position (by throttle opening area) 0.000 – 100.003° TPS • Engine speed 576 – 3,008 RM • Pressure quotient @ throttle 0.27 – 0.60 [-] • Fast throttle adaptation finished • MAP gradient -200.00 – 200.00 kPa/sec • Fuel cut off not active • Time after engine start > 5.0 s • Turbocharger boost pressure 73.00 – 107.50 kPa • BARO 73.00 – 107.50 kPa	• 5.0 s • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Throttle opening area correction included controller and adaptation < 40.00% • Lambda correction included controller and adaptation > 28.00%	• Intake manifold modeled adaptation active • Throttle position (by throttle opening area) 0.000 – 100.003° TPS • Engine speed 576 – 3,008 RPM • Pressure quotient @ throttle 0.27 – 0.60 [-] • Fast throttle adaptation finished • MAP gradient -200.00 – 200.00 kPa/sec • Fuel cut off not active • Time after engine start > 5.0 s • Turbocharger boost pressure 135 kPa • BARO 73.00 – 107.50 kPa			
P0107 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Low	Manifold Pressure Sensor Short To Ground	• Intake manifold pressure sensor voltage < 0.20 V		• 0.5 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0108 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit High	Manifold Pressure Sensor Short To Battery Plus	• Intake manifold pressure sensor voltage > 4.80 V		• 0.5 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .
P0111 Intake Air Temperature Sensor 1 Circuit Range/Performance Bank 1	Intake Air Temperature Sensor Cross Check	• Diff. IAT vs. AAT @ first engine start (depending on engine off time) > 20 K • And • Diff. IAT vs. ROT @ first engine start (depending on engine off time) > 20 K • And • Diff. AAT vs. ROT @ first engine start (depending on engine off time) < 20 K	• Engine off time > 360.00 min • Decrement check to ensure a cold vehicle state: • Diff. IAT vs. min. IAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 s • Diff. ROT vs. min. ROT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 s • Diff. AAT vs. min. AAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 s	• 100 s • Continuous	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0112 Intake Air Temperature Sensor 1 Circuit Low Bank 1	Intake Air Temperature Sensor Short To Ground	• IAT sensor voltage < 0.10 V		• 2.0 s • Continuous	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .
P0113 Intake Air Temperature Sensor 1 Circuit High Bank 1	Intake Air Temperature Sensor Open Circuit	• IAT sensor voltage > 4.50 V		• 2.0 s • Continuous	• 2 DCY	– Check the Intake Manifold Sensor -GX9-. Refer to ⇒ I3.6.19 ntake Manifold SensorGX9, Checking", page 559 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0116 Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	Engine Coolant Temperature Sensor No Change On Signal	• Diff. max. ECT vs. min. ECT < 1.5 K	• ECT range conditions • ECT @ start < 82; > 98° C • And • ECT @ start n.a. • Driving condition H: • Engine part load • Or • Engine full load • Engine speed > 1300 RPM • Vehicle speed >= 50 km/h • Ratio air mass flow to max. air mass flow > 6.0% • Time after conditions are fulfilled > 30 to 60 s • Driving condition L: • Engine idle • Vehicle speed n.a. • Fuel cut off active • Time after conditions are fulfilled > 30 – 60 s	• 120 s • Once / DCY	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 .
	Engine Coolant Temperature Sensor @ Cylinder Block Rationality Check Inappropriately Low	• Diff. min temperature of cross check sensors vs. ECT @ cylinder block @ engine start >= 10° C	• Cross checks finished	• 1.0 s • Once / DCY	• 2 DCY	
	Engine Coolant Temperature Sensor @ Cylinder Block Rationality Check High	• ECT @ cylinder block @ engine start > 40 – 80° C	• Engine off time >= 240.0 min	• 3.0 s • Once / DCY		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Engine Coolant Temperature Sensor @ Cylinder Block Rationality Check Low	• Difference between modeled and measured cylinder block temperature > 10° C	• ECT @ cylinder block -128 – 127° C • Time after engine start > 60.0 s	• 10.0 s • Continuous	• 2 DCY	
P0117 Engine Coolant Temperature Sensor 1 Circuit Low	Engine Coolant Temperature Sensor Short To Ground	• ECT sensor voltage < 0.30 V		• 0.5 s • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 . – Check the coolant thermostat. Refer to the appropriate repair manual.
P0118 Engine Coolant Temperature Sensor 1 Circuit High	Engine Coolant Temperature Sensor Short To Battery / Open Circuit	• ECT sensor voltage > 4.90 V	• IAT at throttle >= -33° C • Time after engine start > 60.0 s	• 0.5 s • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 . – Check the coolant thermostat. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0121 Throttle/ Pedal Position Sensor/ Switch "A" Circuit Range/ Performance	Throttle Position Sensor 1 Rationality Check	• Normalized difference between measured and modeled value of mass air flow from TPS 1 >= 1.00 [-] • Or • Relative mass air flow integral from TPS 1 > 60.00 [-]	• Throttle adaptation (@ initial start or after detection of throttle exchange or checksum error) not active	• 0.01 s • Continuous .	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking”, page 585 .
		• Difference between TPS 1 and TPS 2 > 6.499° TPS		• 0.3 s • Continuous		
P0122 Throttle/ Pedal Position Sensor/ Switch "A" Circuit Low	Throttle Position Sensor 1 Short To Ground	• Throttle position sensor 1 voltage < 0.17 V		• 0.2 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking”, page 585 .
P0123 Throttle/ Pedal Position Sensor/ Switch "A" Circuit High	Throttle Position Sensor 1 Short To Battery Plus	• Throttle position sensor 1 voltage > 4.83 V		• 0.20 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking”, page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0131 O2 Sensor Circuit Low Voltage Bank 1 Sensor 1	Oxygen Sensors Front Short To Ground	• O2S sensor voltage < 0.15 V	• Engine running	• 0.5 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0132 O2 Sensor Circuit High Voltage Bank 1 Sensor 1	Oxygen Sensors Front Short To Battery Plus	• O2S sensor voltage > 5.20 – 5.35 V	• Engine running	• 0.5 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0133 O2 Sensor Circuit Slow Response Bank 1 Sensor 1	Oxygen Sensors Front Dynamic Path Response Check	• Average check • Mean value of normalized signal amplitude >= 0.80 [-] • Ratio check • Ratio of failed diagnostic cycle > n.a. [-]	• CONDITIONS RANGE 1: (standard parameters) • General conditions • Time after engine start n.a. • ECT >= -48° C • Vehicle speed n.a. • Waiting for MAF integral is flown off after gear is changed n.a. • MAF 0.00 – 1,389.00 mg/rev • Integrated MAF in catalyst per cylinder n.a. • Static conditions • O2S front ready • Lambda stimulation active • Lambda control value -35.00 – 35.00 % • Engine speed 928 – 3,008 RPM • MAF to activate diagnosis function 150.00 – 600.00 mg/rev • MAF per segment > 18.00 kg/h • Normalized integrated fuel mass in oil < 255.00 [-] • Catalyst purge not active • Limited dynamic conditions • Integrated MAF after dynamic conditions are fulfilled < n.a. g • Dynamic engine speed < 150 RPM	• 4.4 s • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Dynamic MAF < n.a. mg/rev • Dynamic MAF per segment < 30.00 kg/h • Dynamic lambda < n.a. % • Change of dynamic torque < 0.07 [-] • CONDITIONS RANGE 2: (diagnosis carried out together with the catalyst efficiency diagnosis) • General conditions • Vehicle speed >= 10 km/h • Barometric pressure n.a. • Catalyst overheating protection not active • O2S rear ready • O2S front ready • O2S front pump current valid • O2S heater rear active • internal resistance O2S rear <= 700.00 Ohm • Time after a catalyst purge phase >= 0.02 s • Integrated heat energy >= 1,600.00 – 3,000.00 kJ • Time after engine start > 230.0 – 1,000.0 s • (1.8L) Engine speed 1,280 – 3,008 RPM • (2.0L) Engine speed 1,344 – 3,008 RPM			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Lambda control value < 50.00 % • Deviation of lambda controller output @ start diagnosis < 10.00 % • Deviation of lambda controller output during diagnosis < 8.00 – 15.00 % • Counter lambda controller deviation > 1.00 - • Fast trim control not calibrated • Or • Proportional part of trim control < 0.25 - • Coasting function not active • Lambda adaptation not active • Valve lift not equipped • Temperature conditions: • ECT > 60° C • IAT > -48° C • Modeled catalyst temperature once after engine start > 550° C • Modeled catalyst temp. 500 – 700° C • Modeled catalyst temp. extended range 470 – 730° C • Difference between dynamic and stationary catalyst temp. -254.0 – 254.0 K • Difference between dynamic and stationary catalyst temp. extended range -304.0 – 304.0 K			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Modeled catalyst temperature @ start > 550° C • Integrated MAF, catalyst temp. conditions fulfilled n.a. • Modeled exhaust gas temperature at O2S rear <= 1,201° C • Air mass flow conditions: • MAF per cylinder 40.00 – 130.00 kg/h • MAF per cylinder extended range 35.00 – 135.00 kg/h • MAF 125.01 – 580.00 mg/rev • Air mass during diagnosis not calibrated [mg/rev] • MAF set point 125.01 – 580.00 mg/rev • MAF extended range n.a. mg/rev • Low dynamics conditions • Dynamic engine speed < 20 RPM • Dynamic lambda controller output <= 20.00% • Dynamic MAF < 25.01 mg/stk • Integrated MAF after dynamic conditions are fulfilled > 20.0 g • Evap purge conditions: case 1 • Evap purge valve not calibrated • Case 2:			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Canister load calculation not calibrated • Evap purge flow not calibrated • Case 3 • Canister load not calibrated [-] • Evap purge flow not calibrated • Close the gap conditions: • O2S rear voltage @ diagnosis start >= 0.55 V • Integrated air mass @ start diagnosis not calibrated • O2S front dynamic diagnosis separate not active			
P0135 O2 Sensor Heater Circuit Bank 1 Sensor 1	Oxygen Sensors Heater Front Functional Check	• O2S ceramic temperature < 730° C	• Actuator commanded on • For time >= 10.0 s	• 20 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P0137 O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	Oxygen Sensors Rear Short To Ground	• O2S sensor voltage < 0.15 V	• O2S heater active	• 0.6 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0138 O2 Sensor Circuit High Voltage Bank 1 Sensor 2	Oxygen Sensors Rear Short To Battery	• O2S sensor voltage > 5.2 – 5.35 V	• O2S heater active	• 0.5 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P013A O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	Oxygen Sensors Rear Rich To Lean Transition Response Check At Fuel Cut Off	• Gradient sensor voltage (arithmetic average) < 600.0 mV/sec.	• Integrated heat energy n.a. • Modeled catalyst temp. > 400° C • Vehicle speed 47 – 255 km/h • O2S rear ready • Internal resistance O2S rear < 700.00 Ohm • MAF per cylinder 11.50 – 140.00 kg/h • Sensor voltage at begin of fuel cutoff > 0.67 V • Integrated mass air flow after last fuel cut off >= 85.0 g • Fuel cut off active • Number of checks 2.00 [-]	• 86.5 s • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0140 O2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	Oxygen Sensors Rear Open Circuit	• Internal resistance of O2S (binary) > 65,534.00 Ω		• 2.5 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0141 O2 Sensor Heater Circuit Bank 1 Sensor 2	Oxygen Sensors Rear Out Of Range High	• internal resistance of O2S (binary) 700.00 – 65,534.00 Ω	• Actuator commanded on • For time >= 10.0 s	• 20.0 s • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P0149 Fuel Timing Error	Injection Valves Supply Voltage Out Of Range Low	• Boost voltage < 30.0 V	• Engine running >= 0.3 s	• 3.6 s • Continuous	• 2 DCY	– Check the Fuel Injectors. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
		• Boost voltage <= 50.0 V				
	Injection Valves Supply Voltage Out Of Range High	• Boost voltage > 75.0 V				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0171 System Too Lean Bank 1	Fuel System Too Lean	• Lambda controller output > 35.0%	• Lambda control closed loop • Mass air flow > 60.00 mg/stk • Engine speed > 576 RPM • ECT @ cylinder block > 55° C • IAT at intake manifold > -48° C • AAT > -48° C • Evap purge valve closed • Canister load <= 1.20 [-] • Evap purge flow at max. value • Depending on canister purge min: • Lower limit of lambda controller output n.a. • Upper limit of lambda controller output n.a. • Evap purge flow at min. value	• 60.0 s • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the intake system for leaks, or engine gaskets, oil cap loose/missing that can allow air in via the PCV system. – Check the vacuum lines for leaks.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0172 System Too Rich Bank 1	Fuel System Too Rich	• Lambda controller output < -35.0%	• Lambda control closed loop • Mass air flow > 60.00 mg/stk • Engine speed > 576 RPM • (1.8L) ECT @ cylinder block > 55° C • (2.0L) ECT @ cylinder block > 60° C • IAT at intake manifold > -48° C • AAT > -48° C • Oil dilution not detected • Evap purge valve closed • Canister load <= 1.20 [-] • Evap purge flow at max. value • Depending on canister purge min: • Lower limit of lambda controller output n.a. • Upper limit of lambda controller output n.a. • Evap purge flow at min. value	• 60.0 s • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0190 Fuel Pressure Regulator 1 Control Circuit/Open	Fuel Pressure LP Sensor Short To Battery / Open Circuit	• High fuel pressure sensor voltage > 4.80 V		• 2.0 s • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 .
P0191 Fuel Rail Pressure Sensor Circuit Range/Performance Bank 1	Fuel Rail Pressure (FRP) Out Of Range High	• Fuel pressure > 27,900.09 kPa	• Engine running • Engine speed < 8,160 RPM • Time after engine start > 5.0 s	• 5.0 s. • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 .
P0192 Fuel Rail Pressure Sensor Circuit Low Bank 1	Fuel Pressure LP Sensor Short To Ground	• High fuel pressure sensor voltage < 0.20 V		• 2.0 s • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0201 Cylinder 1 Injector "A" Circuit	Fuel Injection Valves Electrical Error	• Indeterminate fault pattern via powerstage diagnosis detected • Injector low side voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector high side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector low side switch current (hardware values) driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector load resistance to ground and battery > 20.0 Ohm • Injector low side switch current driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 1 Fuel Injector -N30-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Injector load resistance to ground and battery > 20.0 Ohm • ground and battery injector high side switch current driver stage internal value				
	Fuel Injection Valves Open Circuit	• Fault pattern for open circuit via powerstage diagnosis detected • Injector low side voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
	Fuel Injection Valves Short Circuit	• Fault pattern for short circuit via powerstage diagnosis detected • Injector current rise time during peak phase < 0.064 ms				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0202 Cylinder 2 Injector "A" Circuit	Fuel Injection Valves Electrical Error	• Indeterminate fault pattern via powerstage diagnosis detected • Injector low side voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector high side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector low side switch current (hardware values) driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector load resistance to ground and battery > 20.0 Ohm • Injector low side switch current driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 2 Fuel Injector -N31-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Injector load resistance to ground and battery > 20.0 Ohm • Ground and battery injector high side switch current driver stage internal value • Indeterminate fault pattern via powerstage diagnosis detected • Injector low side voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector high side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector low side switch current (hardware values) driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driv-				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		er stage internal value • Injector load resistance to ground and battery > 20.0 Ohm • Injector low side switch current driver stage internal value • Injector load resistance to ground and battery > 20.0 Ohm • Ground and battery injector high side switch current driver stage internal value				
	Fuel Injection Valves Open Circuit	• Fault pattern for open circuit via powerstage diagnosis detected • Injector low side voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
	Fuel Injection Valves Short Circuit	• Fault pattern for short circuit via powerstage diagnosis detected • Injector current rise time during peak phase < 0.064 ms				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0203 Cylinder 3 Injector "A" Circuit	Fuel Injection Valves Electrical Error	• Indeterminate fault pattern via powerstage diagnosis detected • Injector low side voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector high side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector low side switch current (hardware values) driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector load resistance to ground and battery > 20.0 Ohm • Injector low side switch current driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 0.5 s	• 2 DCY	– Check the Cylinder 3 Fuel Injector -N32-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Injector load resistance to ground and battery > 20.0 Ohm • Ground and battery injector high side switch current driver stage internal value				
	Fuel Injection Valves Open Circuit	• Fault pattern for open circuit via powerstage diagnosis detected • Injector low side voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
	Fuel Injection Valves Short Circuit	• Fault pattern for short circuit via powerstage diagnosis detected • Injector current rise time during peak phase < 0.064 ms				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0204 Cylinder 4 Injector "A" Circuit	Fuel Injection Valves Electrical Error	• Indeterminate fault pattern via powerstage diagnosis detected • Injector low side voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector high side switch current driver stage internal value • Injector low side voltage < 2.0 V • Injector low side switch current (hardware values) driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector voltage < 2.0 V • Injector low side switch current driver stage internal value • Injector load resistance to ground and battery > 20.0 Ohm • Injector low side switch current driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 4 Fuel Injector -N33-. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Injector load resistance to ground and battery > 20.0 Ohm • ground and battery injector high side switch current driver stage internal value				
	Fuel Injection Valves Open Circuit	• Fault pattern for open circuit via powerstage diagnosis detected • Injector low side voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
	Fuel Injection Valves Short Circuit	• Fault pattern for short circuit via powerstage diagnosis detected • Injector current rise time during peak phase < 0.064 ms				
P0221 Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance	Throttle Position Sensor 2 Rationality Check	• Normalized difference between measured and modeled value of mass air flow from TPS 2 >= 1.00 [-] • Or • Relative mass air flow integral from TPS 2 > 60.00 [-]	• Throttle adaptation (@ initial start or after detection of throttle exchange or checksum error) not active	• 0.01 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking”, page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0222 Throttle/ Pedal Position Sensor/ Switch "B" Circuit Low	Throttle Position Sensor 2 Short To Ground	• Throttle position sensor 2 voltage < 0.17 V		• 0.2 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P0223 Throttle/ Pedal Position Sensor/ Switch "B" Circuit High	Throttle Position Sensor 2 Short To Battery Plus	• Throttle position sensor 2 voltage > 4.83 V		• 0.2 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P0234 Turbocharger/ Supercharger "A" Overboost Condition	Turbocharger Boost Pressure Control Out Of Range High	• Boost pressure > calculated max. plausible value • And • Boost pressure deviation < 209.90 – 265.00 kPa • Or • Turbocharger protection active	• Engine running • Accelerator pedal value > 0.00% • Fuel cut off n.a. • Difference between boost pressure and barometric pressure >= 20.00 kPa	• 1.3 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0236 Turbocharger/Supercharger Boost Sensor "A" Circuit Range/Performance	Turbocharger Boost Pressure Sensor Cross Check (Engine Standing)	• Diff. turbocharger boost pressure vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure > 7.50 kPa • Diff. BARO vs. MAP <= 7.50 kPa	• Case 1: Engine stop during DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a. • For time >= 10.0 s • Case 2: engine stop @ start of DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a.	• 3.0 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .
	Turbocharger Boost Pressure Sensor Cross Check (ECM Keep Alive Time)		• Engine stopped • Vehicle speed < 1 km/h • ECM keep alive-time 10.0 – 6,553.5 s • Time after engine stop >= 5.0 s • BARO sensor voltage 0.20 – 4.80 V • MAP sensor voltage 0.20 – 4.80 V • Boost pressure sensor voltage 0.20 – 4.80 V			
P0237 Turbocharger/Supercharger Boost Sensor "A" Circuit Low	Turbocharger Boost Pressure Sensor Short To Ground	• Turbocharger boost pressure sensor voltage < 0.20 V		• 0.5 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0238 Turbocharger/Supercharger Boost Sensor "A" Circuit High	Turbocharger Boost Pressure Sensor Short To Battery Plus	• Turbocharger boost pressure sensor voltage > 4.80 V		• 0.5 s • Continuous .	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 .
P025A Fuel Pump Module "A" Control Circuit/Open	Fuel Pump Open Circuit	• Signal voltage, lower range > 1.92 – 2.21 V • Signal voltage, upper range (hardware values) < 2.84 – 3.25 V	• Commanded PWM 9.80 – 92.20% • Actuator commanded off	• 0.5 s • Continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .
P025C Fuel Pump Module "A" Control Circuit Low	Fuel Pump Short To Ground	• Signal voltage (hardware values > 1.92 – 2.21 V	• Commanded PWM 9.80 – 92.20% • Actuator commanded off	• 0.5 s • Continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P025D Fuel Pump Module "A" Control Circuit High	Fuel Pump Short To Battery Plus	• Power stage temperature > 160.0 – 200.0° C • Signal current (hardware values) driver stage internal value	• Commanded PWM 9.80 – 92.20% • Actuator commanded on	• 0.5 s • Continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking”, page 544 .
P0261 Cylinder 1 Injector "A" Circuit Low	Fuel Injection Valves Short To Ground	• Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 1 Fuel Injector -N30-. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 .
	Fuel Injection Valves Short To Ground (High Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Fuel Injection Valves Short To Ground (Low Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current driver stage internal value • Injector driver low side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0262 Cylinder 1 Injector "A" Circuit High	Fuel Injection Valves Short To Battery Plus	• Fault pattern for short to battery plus via power-stage diagnosis detected • Injector voltage > 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 1 Fuel Injector -N30-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Fuel Injection Valves Short To Battery Plus (High Side)	• Injector driver voltage > 2.0 V • And • injector driver high side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Fuel Injection Valves Short To Battery Plus (Low Side)	• Injector driver voltage > 2.0 V • And • injector driver low side switch current (hardware values) driver stage internal value				
P0264 Cylinder 2 Injector "A" Circuit Low	Fuel Injection Valves Short To Ground	• Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 2 Fuel Injector -N31-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Fuel Injection Valves Short To Ground (High Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Injection Valves Short To Ground (Low Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current driver stage internal value • Injector driver low side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
P0265 Cylinder 2 Injector "A" Circuit High	Fuel Injection Valves Short To Battery Plus	• Fault pattern for short to battery plus via power-stage diagnosis detected • Injector voltage > 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 2 Fuel Injector -N31-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Fuel Injection Valves Short To Battery Plus (High Side)	• Injector driver voltage > 2.0 V • And • Injector driver high side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	FuelInjection Valves Short To Battery Plus (Low Side)	• Injector driver voltage > 2.0 V • And • Injector driver low side switch current (hardware values) driver stage internal value				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0267 Cylinder 3 Injector "A" Circuit Low	Fuel Injection Valves Short To Ground	• Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 3 Fuel Injector -N32-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Fuel Injection Valves Short To Ground (High Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Fuel Injection Valves Short To Ground (Low Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current driver stage internal value • Injector driver low side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
P0268 Cylinder 3 Injector "A" Circuit High	Fuel Injection Valves Short To Battery Plus	• Fault pattern for short to battery plus via powerstage diagnosis detected • Injector voltage > 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 3 Fuel Injector -N32-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Injection Valves Short To Battery Plus (High Side)	• Injector driver voltage > 2.0 V • And • Injector driver high side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Fuel Injection Valves Short To Battery Plus (Low Side)	• Injector driver voltage > 2.0 V • And • Injector driver low side switch current (hardware values) driver stage internal value				
P0270 Cylinder 4 Injector "A" Circuit Low	Fuel Injection Valves Short To Ground	• Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 4 Fuel Injector -N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Fuel Injection Valves Short To Ground (High Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Fuel Injection Valves Short To Ground (Low Side)	• Injector driver voltage < 2 V • And • Injector driver high side switch current driver stage internal value • Injector driver low side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.			
P0271 Cylinder 4 Injector "A" Circuit High	Fuel Injection Valves Short To Battery Plus	• Fault pattern for short to battery plus via power-stage diagnosis detected • Injector voltage > 2.0 V	• Engine stop not active • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 8,640.0° CRK • Continuous	• 2 DCY	– Check the Cylinder 4 Fuel Injector -N33-. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 .
	Fuel Injection Valves Short To Battery Plus (High Side)	• Injector driver voltage > 2.0 V • And • Injector driver high side switch current (hardware values) driver stage internal value	• Engine running • ECT @ cylinder block >= -30° C • Engine speed < 7,000 RPM • Injection time n.a.	• 720.0° CRK • Continuous		
	Fuel Injection Valves Short To Battery Plus (Low Side)	• Injector driver voltage > 2.0 V • And • Injector driver low side switch current (hardware values) driver stage internal value				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0299 Turbocharger/Supercharger "A" Underboost Condition	Turbocharger Boost Pressure Control Out Of Range Low	• Boost pressure < calculated min. plausible value • And • Boost pressure deviation > 5.00 kPa	• Engine running • Turbo charger bypass valve closed • For time >= 1.0 s • Pressure ratio before charger set point > 1.30 [-] • For time >= 1.2 – 1.9 s • Engine speed > 2,208 – 2,750 RPM • Barometric pressure > 73.00 kPa • ECT > -10° C • No cylinder is shut off fuel tank level n.a.	• 4.0 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Sensor -G31-. Refer to ⇒ C3.6.7 harge Air Pressure Sensor G31, Checking", page 535 – Check the charge air system for proper seal. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Intake Manifold Adaptive Value Check	• Turbo charger actuator set point >= 17.0 – 20.0%	• Engine running • Conditions: • For time >= 0.5 s • Difference between filtered boost pressure and basic boost pressure > 40.01 kPa • Difference between filtered boost pressure set point and basic boost pressure > 40.01 kPa • Boost pressure control deviation < 20.0 kPa • Boost pressure set point < 16.0 kPa • Actual boost pressure < 30.0 kPa • Difference between current boost pressure set point and basic boost pressure > 3.0 kPa • ECT > -20° C • IAT @ throttle > 0° C • Engine speed 2,500 – 6,800 RPM • Condition: • For time >= 5,000 ms. • Difference between actual turbocharger speed and maximum turbocharger speed set point > 9,003 RPM • Conditions: • For time >= 1,000 ms. • No gear shift • Fuel cut off not active	• 0.01 s • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0300 Random/ Multiple Cylinder Misfire Detected	Misfire Crankshaft Speed Fluctuation (Multiple)	• Number of cylinders with emission threshold misfire within 4,000 revolutions >= 2.00 [-] • Or • Number of cylinders with emission threshold misfire within 1,000 revolutions >= n.a. [-]	• Emission threshold misfire detected	• 1,000 (rev) • Continuous	• 2 DCY	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 . – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking”, page 553 .
		• Number of cylinders with catalyst damaging misfire >= 2.00 [-]	• Catalyst damaging misfire detected	• 200 (rev) • Continuous	• Immediately	
P0301 Cylinder 1 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	• Catalyst damage misfire • 1.8L : Catalyst damaging misfire rate > 5.55 – 62.50% • 2.0L : Catalyst damaging misfire rate > 5.55 – 31.25%	• Initial engine speed > 550 RPM • Engine speed > 550 RPM • Engine speed < 6,848 RPM • Time after engine start not calibrated s • 1.8L : Engine load > 5.26 – 44.49% • 2.0L : Engine load > 4.36 – 44.00% • For A/T: • Depending on ECT @ cylinder block @ start	• 200 Rev. • Continuous	• Immed.	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking”, page 547 . – Check the Ignition Coils with Power Output
		• Emission threshold misfire within_1,000_rev • Emission threshold misfire rate (MR) not calibrated		• 1,000 Rev. • Continuous	• 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Emission threshold misfire within_4,000_rev • Emission threshold misfire rate (MR) > 2.75%	• ECT @ cylinder block @ engine start <= -48° C • Then activation if • ECT @ cylinder block >= 20° C • ECT @ cylinder block @ engine start > -48° C • Fuel cut off not active • Single fuel cut off not active • Number of fade out cylinders < 2.00 [-] • Dynamic manifold air pressure not calibrated kPa • Dynamic throttle position not calibrated °TPS / sec. • Engine not calibrated • Engine speed not calibrated RPM • Dynamic of ignition angle not calibrated ° CRK • Dynamic of ignition angle not calibrated ° CRK • Rough road not detected	• 4 x 1,000 Rev. • Continuous		Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P0302 Cylinder 2 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	• Catalyst damage misfire • 1.8L : Catalyst damaging misfire rate > 5.55 – 62.50% • 2.0L : Catalyst damaging misfire rate > 5.55 – 31.25%	• Initial engine speed > 550 RPM • Engine speed > 550 RPM • Engine speed < 6,848 RPM • Time after engine start not calibrated s • 1.8L : Engine load > 5.26 – 44.49%	• 200 Rev. • Continuous	• Immed.	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Emission threshold misfire within_1,000_rev • Emission threshold misfire rate (MR) not calibrated	• 2.0L : Engine load > 4.36 – 44.00% • For A/T: • Depending on ECT @ cylinder block @ start • ECT @ cylinder block @ engine start <= -48° C • Then activation if • ECT @ cylinder block >= 20° C • ECT @ cylinder block @ engine start > -48° C • Fuel cut off not active • Single fuel cut off not active • Number of fade out cylinders < 2.00 [-] • Dynamic manifold air pressure not calibrated kPa • Dynamic throttle position not calibrated °TPS / sec. • Engine not calibrated • Engine speed not calibrated RPM • Dynamic of ignition angle not calibrated ° CRK • Dynamic of ignition angle not calibrated ° CRK • Rough road not detected	• 1,000 Rev. • Continuous	• 2 DCY	F3.6.13 uel Injector, Checking", page 547 . – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
		• Emission threshold misfire within_4,000_rev • Emission threshold misfire rate (MR) > 2.75%		• 4 x 1,000 Rev. • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0303 Cylinder 3 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	• Catalyst damage misfire • 1.8L : Catalyst damaging misfire rate > 5.55 – 62.50% • 2.0L : Catalyst damaging misfire rate > 5.55 – 31.25%	• Initial engine speed > 550 RPM • Engine speed > 550 RPM • Engine speed < 6,848 RPM • Time after engine start not calibrated s • 1.8L : Engine load > 5.26 – 44.49% • 2.0L : Engine load > 4.36 – 44.00% • For A/T: • Depending on ECT @ cylinder block @ start • ECT @ cylinder block @ engine start <= -48° C • Then activation if • ECT @ cylinder block >= 20° C • ECT @ cylinder block @ engine start > -48° C • Fuel cut off not active • Single fuel cut off not active • Number of fade out cylinders < 2.00 [-] • Dynamic manifold air pressure not calibrated kPa • Dynamic throttle position not calibrated °TPS / sec. • Engine not calibrated • Engine speed not calibrated RPM	• 200 Rev. • Continuous	• Immed.	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
		• Emission threshold misfire within_1,000_rev • Emission threshold misfire rate (MR) not calibrated		• 1,000 Rev. • Continuous	• 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Emission threshold misfire within_4,000_rev • Emission threshold misfire rate (MR) > 2.75%	• Dynamic of ignition angle not calibrated ° CRK • Dynamic of ignition angle not calibrated ° CRK • Rough road not detected	• 4 x 1,000 Rev. • Continuous		
P0304 Cylinder 4 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	• Catalyst damage misfire • 1.8L : Catalyst damaging misfire rate > 5.55 – 62.50% • 2.0L : Catalyst damaging misfire rate > 5.55 – 31.25%	• Initial engine speed > 550 RPM • Engine speed > 550 RPM • Engine speed < 6,848 RPM • Time after engine start not calibrated s • 1.8L : Engine load > 5.26 – 44.49 % • 2.0L : Engine load > 4.36 – 44.00 % • For A/T: • Depending on ECT @ cylinder block @ start • ECT @ cylinder block @ engine start <= -48° C • Then activation if • ECT @ cylinder block >= 20° C • ECT @ cylinder block @ engine start > -48° C • Fuel cut off not active • Single fuel cut off not active • Number of fade out cylinders < 2.00 [-] • Dynamic manifold air pressure not calibrated kPa • Dynamic throttle position not cali-	• 200 Rev. • Continuous	• Immed.	– Check the spark plugs with a visual inspection. – Check the intake system visually for leaks. – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
		• Emission threshold misfire within_1,000_rev • Emission threshold misfire rate (MR) not calibrated		• 1,000 Rev. • Continuous	• 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Emission threshold misfire within_4,000_rev • Emission threshold misfire rate (MR) > 2.75%	brated °TPS / sec. • Engine not calibrated • Engine speed not calibrated RPM • Dynamic of ignition angle not calibrated ° CRK • Dynamic of ignition angle not calibrated ° CRK • Rough road not detected	• 4 x 1,000 Rev. • Continuous		
P0326 Knock/Combustion Vibration Sensor 1 Circuit Range/Performance Bank 1 or Single Sensor	Knock Sensor Rationality Check Low	• Difference between knock sensor signal and average knock sensor signal < 0.00 – 0.12 V	• ECT @ cylinder block > 60° C • MAF > 229.0 mg/rev	• 4.3 s • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0327 Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor	Knock Sensor Out Of Range	• Sensor signal < 0.12 – 0.31 V	• ECT @ cylinder block > 60° C • MAF > 229.00 mg/rev • Engine speed > 2,016 RPM	• 4.0 s • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking”, page 561 .
P0335 Crankshaft Position Sensor "A" Circuit	Crankshaft Position Sensor CKP activity check	• Pulse width backwards < 62; > 150 [µs] • For number of pulse widths outside tolerance > 1.00 [-] • Or • Pulse width forwards < 15; > 62 [µs] • For number of pulse widths outside tolerance > 1.00 [-]	• Engine speed > 32; < 1200 RPM	• 1,800.0° CRK • Continuous	• 2 DCY	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking”, page 526 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Crankshaft Position Sensor Activity Check	• Case 1: • Counted exhaust camshaft signals without synchronization >= n.a [-] • Or • Counted intake camshaft signals without synchronization >= n.a. [-] • Case 2: • Counted exhaust camshaft signals without synchronization >= 1.00 [-] • Or • Counted intake camshaft signals without synchronization >= 17.0 [-]	• Signal edges @ selected camshaft signal detected • Choice of: • Ignition off • Engine speed > 380 RPM • Engine stalling >= 1.0 s • Synchronization test incorrect • Engine speed >= 380 RPM • Engine running • Engine stalling >= 5.0 s • Backwards rotation not detected • Engine speed >= 400 RPM • Engine stop active	• 0.01 s • Continuous		
P0336 Crankshaft Position Sensor "A" Circuit Range/ Performance	Crankshaft Position Sensor Rationality Check	• Crankshaft synchronization lost	• Engine running	• 2,160.0° CRK • Continuous	• 2 DCY	– Check the Camshaft Position Sensor - G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .
		• One or two additional teeth recognized incorrect • One or two teeth missed	• Engine speed > 320 RPM	• 1,800.0° CRK • Continuous	• 2 DCY	
		• Sensor signal < 50 – 156 [µs] • Engine speed > 1,200 RPM • Sensor signal < 30 [µs] • Engine speed <= 1,200 RPM	• Engine running	• 45,720.0° CRK • Continuous	• 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Crankshaft Position Sensor Out Of Range	• Segment adaptation >= 7.0%	• Fuel cut off all cylinders active • Segments in fuel cut-off mode >= 32.0 [-]	• 180.0° CRK • Continuous	• 2 DCY	
P0340 Camshaft Position Sensor "A" Circuit Bank 1 or Single Sensor	Camshaft Position Sensor Intake Signal Activity Check	• Signal change not detected • For number of reference gap >= 3.00 [-]	• Engine speed > 32 RPM	• 2,520° CRK • Continuous	• 2 DCY	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .
P0341 Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor	Camshaft Position Sensor Intake Signal Activity Check	• Segment time value < 50 µs	• Engine speed > 32; < 8,160 RPM	• 1,440.00° CRK • Continuous	• 2 DCY	– Check the Camshaft Position Sensor -G40-. Refer to ⇒ C3.6.3 amshaft Position SensorG40, Checking", page 526 .
	Camshaft Position Sensor Intake Angular Offset Check	• Offset between camshaft and crankshaft < -79.00; > 15.00° CRK	• Engine speed > 32 RPM	• 450.0° CRK • Once / DCY		
	Camshaft Position Sensor Intake Rationality Check	• Segment period ratio factor < 0.36; > 2.75 [-] • Or • Offset between camshaft and crankshaft < -79.0; > 15.0° CRK	• Engine speed > 32; < 8,160 RPM	• 952.50° CRK • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P039B Cylinder 1 Pressure Too High	Knock Control Function Check	• Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.0 – 3.0 [-] • For time >= 9,000.0 – 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.0 [-] • For time >= 5,760.0 – 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.0 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.0 – 3.0 [-] • For time >= 12,960.0 – 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 – 501.0 mg/rev • Dynamic engine speed not active • Delay time n.a.	• 900.0° CRK • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Fast detection: • Ratio between knock sensor and knock threshold in main knock window > 1.50 – 2.50 [-] • For time >= 540.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 2.75 – 4.50 [-] • For time >= 360.0° CRK • Case 1: • Ratio between filtered engine roughness and misfire detection threshold <= 0.41 – 0.59 [-] • Or • Case 2: • Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-] • Or • Case 3: • Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 – 501.0 mg/rev • Misfire detection active • Dynamic engine speed not active • Delay time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Or • Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-]				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P03A5 Cylinder 2 Pressure Too High	Knock Control Function Check	• Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.0 – 3.0 [-] • For time >= 9,000.0 – 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.0 [-] • For time >= 5,760.0 – 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.0 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.0 – 3.0 [-] • For time >= 12,960.0 – 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 – 501.0 mg/rev • Dynamic engine speed not active • Delay time n.a.	• 900.0° CRK • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Fast detection: • Ratio between knock sensor and knock threshold in main knock window > 1.50 – 2.50 [-] • For time >= 540.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 2.75 – 4.50 [-] • For time >= 360.0° CRK • Case 1: • Ratio between filtered engine roughness and misfire detection threshold <= 0.41 – 0.59 [-] • Or • Case 2: • Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-] • Or • Case 3: • Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 – 501.0 mg/rev • Misfire detection active • Dynamic engine speed not active • Delay time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Or • Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-]				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	• Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.0 – 3.0 [-] • For time >= 9,000.0 – 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.0 [-] • For time >= 5,760.0 – 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.0 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.0 – 3.0 [-] • For time >= 12,960.0 – 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 – 501.0 mg/rev • Dynamic engine speed not active • Delay time n.a.	• 900.0° CRK • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Fast detection: • Ratio between knock sensor and knock threshold in main knock window > 1.50 – 2.50 [-] • For time >= 540.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 2.75 – 4.50 [-] • For time >= 360.0° CRK • Case 1: • Ratio between filtered engine roughness and misfire detection threshold <= 0.41 – 0.59 [-] • Or • Case 2: • Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-] • Or • Case 3: • Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 – 501.0 mg/rev • Misfire detection active • Dynamic engine speed not active • Delay time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Or • Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-]				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P03B9 Cylinder 4 Pressure Too High	Knock Control Function Check	• Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.0 – 3.0 [-] • For time >= 9,000.0 – 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.0 [-] • For time >= 5,760.0 – 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.0 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.0 – 3.0 [-] • For time >= 12,960.0 – 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 – 501.0 mg/rev • Dynamic engine speed not active • Delay time n.a.	• 900.0° CRK • Continuous	• 2 DCY	– Check the Knock Sensor 1 -G61-. Refer to ⇒ K3.6.20 nock Sensor 1G61, Checking", page 561 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Fast detection: • Ratio between knock sensor and knock threshold in main knock window > 1.50 – 2.50 [-] • For time >= 540.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 2.75 – 4.50 [-] • For time >= 360.0° CRK • Case 1: • Ratio between filtered engine roughness and misfire detection threshold <= 0.41 – 0.59 [-] • Or • Case 2: • Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-] • Or • Case 3: • Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-]	• Engine running • ECT @ cylinder block > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.0 – 501.0 mg/rev • Misfire detection active • Dynamic engine speed not active • Delay time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Or • Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-]				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0420 Catalyst System Efficiency Below Threshold Bank 1	Catalyst System NMOG / NMHC / NOX Conversion Capability	• Cat efficiency (arithmetic average) > 1.00 [-] • EWMA filtered • catalyst efficiency not calibrated [-] • Arithmetic average, corrected with measured delay and transition time of Oxygen Sensors rear • Catalyst efficiency not calibrated [-] • EWMA filtered, corrected with measured delay and transition time of Oxygen Sensors rear • Catalyst efficiency not calibrated [-]	• General conditions • Vehicle speed >= 10 km/h • Barometric pressure n.a. • Catalyst overheating protection not active • turbine overheating protection not active • O2S rear ready • O2S front ready • O2S heater rear active • Internal resistance O2S rear <= 700 Ω • Time after catalyst purge phase >= 0.02 s • Integrated heat energy >= 1,600.00 – 3,000.00 kJ • Time after engine start > 230.0 –1,000.0 s • Engine speed (2.0L) 1,344 – 3,008 rpm • Engine speed (1.8L) 1,280 – 3,008 rpm • Lambda control value < 50 % • Deviation of lambda controller output @ start diagnosis < 10.00 % • Deviation of lambda controller output during diagnosis < 8.00 – 15.00 % • Fast trim control not calibrated • Proportional part of secondary fuel	• 86.5 s • Once / DCY	• 2 DCY	– Check the Three Way Catalytic Converter (TWC). Refer to ⇒ W3.6.30 ay Catalytic Converter (TWC), Checking", page 584 . – Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			control loop < 0.25 - • Lambda adaptation not active • Coasting function not active • Valve lift not active • Temperature conditions • ECT > 60° C • IAT > -48° C • Modeled catalyst temp. 500 – 700° C • Modeled catalyst temp. extended range 470 – 730° C • Integrated MAF, catalyst temp. conditions fulfilled not calibrated • Difference between dynamic and stationary catalyst temp. -254.0 – 254.0 K • Difference between dynamic and stationary catalyst temp. extended range -304.0 – 304.0 K • Modeled catalyst temperature @ start > 550° C • Modeled exhaust gas temperature at O2S rear <= 1201° C • Air mass flow conditions • MAF per cylinder 40.00 – 130.00 kg/h • MAF per cylinder extended range 35.00 – 135.00 kg/h • MAF 125.01 – 580.00 mg/rev			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• MAF set point 125.0 – 580.0 mg/rev • MAF extended range n.a. mg/rev • Limited dynamics conditions • Dynamic engine speed < 20 RPM • Dynamic lambda controller output <= 20.00 % • Dynamic MAF < 25.01 mg/stk • Integrated MAF after dynamic conditions are fulfilled > 20.0 g • Evap purge conditions • Canister load <= 2.00 [-] • Or • Evap purge valve not calibrated • Canister load calculation not calibrated • Evap purge flow not calibrated • Case 3 • Canister load not calibrated [-] • Evap purge flow not calibrated • Close the gap conditions: • O2S rear voltage @ diagnosis start >= 0.55 V • Integrated air mass @ start diagnosis not calibrated [g] • O2S front dynamic diagnosis separate not active			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• For arithmetic average value calculation: • Number of checks required for valid result >= 3.00 [-] • For EWMA-filter: • Minimum number of tests per DCY required not calibrated • Step change detection will initiate multiple tests per DCY Conditions for step change detection: relative deviation between new measured value and old EWMA filtered value not calibrated [-] • Number of checks not calibrated [-]			
P043E EVAP System Leak Detection Reference Orifice Low Flow	Evaporative Emission (EVAP) System Out Of Range High	• EVAP pump current during reference measurement > 40.0 mA	• Barometric pressure > 73.00 kPa • AAT 4 – 38° C • ECT @ start >= 4° C • Vehicle speed < 1 km/h • Time since engine start in preceding DCY >= 600.0 s • Difference between ECT and AAT @ start not calibrated K • Engine stop (during ECM keep alive-time) • Air bag not activated • Propulsion off time >= 21,600.0 s	• 624.0 s • Once / DCY	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking”, page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P043F EVAP System Leak Detection Reference Orifice High Flow	Evaporative Emission (EVAP) System Out Of Range Low	• EVAP pump current during reference measurement < 15 mA	• Barometric pressure > 73.00 kPa • AAT 4 – 38° C • ECT @ start >= 4° C • Vehicle speed < 1 km/h • Time since engine start in preceding DCY >= 600.0 s • Difference between ECT and AAT @ start not calibrated K • Engine stop (during ECM keep alive-time) • Air bag not activated • Propulsion off time >= 21,600.0 s	• 624.0 s • Once / DCY	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0441 EVAP System Incorrect Purge Flow	EVAP Purge Valve Functional Check: Stuck Close	• Ratio actual intake manifold pressure and modeled set point intake manifold pressure < 0.05 [-]	• ECT @ cylinder block > 58° C • Barometric pressure > 73.0 kPa • AAT > 5° C • AAT @ start >= 5° C • Diff. barometric pressure vs. filtered intake manifold pressure >= 25.00 kPa • Diff. barometric pressure vs. filtered intake manifold pressure > 25.0 – 40.0 kPa • Ratio MAF @ intake manifold and MAF max. > 0.07 – 0.09 [-] • Engine speed < 2,800 RPM • Vehicle speed >= 5 km/h • Coasting function not calibrated • Engine speed > 1,180 RPM • Diff. engine speed vs. filtered engine speed < 90 RPM • Diff. ratio MAF @ intake manifold and MAF max vs. ratio filtered MAF @ intake manifold and MAF max < 0.15 [-] • Diff. modeled intake manifold pressure vs. filtered modeled intake manifold pressure < 1.50 kPa • Integrated MAF since engine start >= 0.0 – 5,000.0 g	• 8.5 s • Once / DCY	• 2 DCY	– Check the EVAP System for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 . – Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Lambda conditions fulfilled • Lambda control active • Lambda control value -30.00 – 30.00% • O2S front 0.95 – 1.05 [-] • Fuel cut off not calibrated • Case 1: • Integrated MAF @ canister purge per driving cycle >= not calibrated g • Case 2: • Integrated MAF @ canister purge valve >= 2.1 g • Ratio MAF @ canister purge and MAF per cylinder not calibrated • Canister purge sampling rate >= 40.00 % • Depending on AAT: • AAT >= 20° C • Canister load <= 0.09 [-] • Or • AAT >= 30; < 20° C • Canister load <= 0.09 [-] • Or • AAT < 30° C • Canister load <= 0.32 [-]			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0442 EVAP System Leak Detected (small leak)	Evaporative Emission (EVAP) System Small Leak Rationality Check	• Difference pump current vs. rough leak reference current < 0 mA • For time >= 600.0 s	• Barometric pressure > 73.00 kPa • AAT 4 – 38° C • ECT @ start >= 4° C • Vehicle speed < 1 km/h • Time since engine start in preceding dcy >= 600.0 s • Difference between ECT and AAT @ start not calibrated • propulsion off time engine stop (during ECM keep alive-time) >= 21,600.0 >= 21,600.0 s	• 624.0 s. • Once / DCY	• 2 DCY	– Check the EVAP System for Leaks. Refer to ⇒ S2.2.4 ystem, Checking for Leaks", page 12 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 . – Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P0444 EVAP System Purge Control Valve "A" Circuit Open	Evaporative Emission (EVAP) Canister Purge Valve Open Circuit	• Output voltage, lower range >= 1.92 – 2.21 V • Output voltage, upper range (hardware values) <= 2.85 – 3.25 V	• Engine start not active • Engine running • Evap purge valve opening signal (PWM) > 3.13; <= 98.83% • Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0445 EVAP System Purge Control Valve "A" Circuit Shorted	Evaporative Emission (EVAP) Canister Purge Valve Short To Ground	• Output voltage (hardware values) 1.92 – 2.21 V	• Engine start not active • Engine running • Evap purge valve opening signal (PWM) <= 98.83% • Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .
	Evaporative Emission (EVAP) Canister Purge Valve Short To Battery Plus	• Actuator temperature 160 – 200° C • Or • Output current (hardware values) driver stage internal value	• Engine start not active • Engine running • Evap purge valve opening signal (PWM) >= 3.13% • Actuator commanded on			
P0447 EVAP System Vent Control Circuit Open	Evaporative Emission (EVAP) Leak Detection Pump (LDP) Open Circuit	• Output voltage, lower range 1.85 – 2.28 V • Output voltage, upper range (hardware values) 2.75 – 3.36 V	• Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P0448 EVAP System Vent Control Circuit Shorted	Evaporative Emission (EVAP) Leak Detection Pump (LDP) Short To Ground	• Output voltage (hardware values) < 1.85 – 2.28 V	• Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
	Evaporative Emission (EVAP) Leak Detection Pump (LDP) Short To Battery Plus	• Actuator temperature > 155 – 185° C • Or • Output current (hardware values) driver stage internal value	• Actuator commanded on			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0501 Vehicle Speed Sensor "A" Circuit Range/ Performance	COM: Vehicle Speed Sensor (VSS) Communication With Vehicle Speed Sensor	• Speed sensor fault value: out of range high failure • Speed sensor fault value: out of range low failure • Speed sensor fault value: rationality check high failure • Speed sensor fault value: rationality check low failure		• 0.5 s • Continuous	• 2 DCY	– Check vehicle speed signal. Refer to ⇒ S3.6.33 peed Signal, Checking", page 589 .
P0502 Vehicle Speed Sensor "A" Circuit Low	Vehicle Speed Sensor short to ground Vehicle Speed Sensor open circuit Vehicle Speed Sensor short to battery plus	• Diagnostic signal from output driver failure		• 0.5 s • Continuous	• 2 DCY	– Check vehicle speed signal. Refer to ⇒ S3.6.33 peed Signal, Checking", page 589 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0506 Idle Control System RPM - Lower Than Expected	Idle Speed Control (ISC) Function Monitoring: Engine Speed Deviation	• Diff. actual engine speed vs. engine speed setpoint < -100 RPM • Integrated I-part of idle speed controller n.a.	• General conditions: • Vehicle speed = 0 km/h torque safety limitation not active • Accelerator pedal released by driver • Throttle actuator commanded on • Evap purge flow < 8.00 kg/h • Engine running • Time after engine start n.a. • Clutch switch n.a. • Barometric pressure > 70.00 kPa • Catalyst heating not active • ECT @ cylinder block > -48° C • Set point change < n.a. RPM • For time >= n.a. sec. • Additional after dynamic conditions fulfilled: • For time n.a. • Gear switch (automatic transmission only) not active • Driver request not active • Vehicle speed 0 km/h • Engine load (manual transmission only) < 30.47 %	• 10.0 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0507 Idle Control System RPM - Higher Than Expected	Idle Speed Control (ISC) Function Monitoring: Engine Speed Deviation	• Diff. actual engine speed vs. engine speed setpoint > 200 RPM • Integrated I-part of idle speed controller n.a.	• General conditions: • Vehicle speed = 0 km/h torque safety limitation not active • Accelerator pedal released by driver • Throttle actuator commanded on • Evap purge flow < 8.00 kg/h • Engine running • Time after engine start n.a. • Clutch switch n.a. • Barometric pressure > 70.00 kPa • Catalyst heating not active • ECT @ cylinder block > -48° C • And • Set point change < n.a. RPM • For time >= n.a. sec. • Additional after dynamic conditions fulfilled: • Gear switch (automatic transmission only) not active • accelerator pedal released by driver • Vehicle speed 0 km/h • For time not calibrated	• 10.0 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P05A0 Active Grille Air Shutter	Active Grille Air Shutter Functional Check	• Blocked active grille air shutter detected	• AAT n.a.	• 0.3 s • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
"A" Stuck On		• Uncontrolled adjustment detected				MotorV544, Checking", page 575 .
P05A2 Active Grille Air Shutter "A" Control Circuit/ Open	Active Grille Air Shutter Open Circuit	• Signal voltage, lower range > 1.92 – 2.21 V • Signal voltage, upper range < 2.85 – 3.25 V		• 0.5 s	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .
P05A3 Active Grille Air Shutter "A" Control Circuit Range/ Performance	Active Grille Air Shutter Functional Check	• Internal logic failure detected		• 0.3 s • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .
		• Initialization failure detected		• 0.0 s • Continuous	• 2 DCY	
	Active Grille Air Shutter Activity Check	• Active grille air shutter controller feedback signal failed		• 24 s • Continuous	• 2 DCY	
P05A4 Active Grille Air Shutter "A" Control Circuit High	Active Grille Air Shutter Short To Battery Plus	• Power stage temperature > 160.0 – 200.0° C • Or • Signal current driver stage internal value		• 0.5 s • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P05A5 Active Grille Air Shutter "A" Control Circuit High	Active Grille Air Shutter Short To Ground	• Signal voltage < 1.92 – 2.21 V	• Recording time of signal voltage > 3.3 s • Active grille air shutter feedback failure not detected	• 0.5 s • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .
P05C0 Active Grille Air Shutter Module "A" Over Temperature	Active Grille Air Shutter Functional Check	• Internal over voltage detected • Internal over-temperature detected		• 0.3 s • Continuous	• 2 DCY	– Check the Radiator Shutter Motor -V544-. Refer to ⇒ R3.6.26 adiator Shutter MotorV544, Checking", page 575 .
P0601 Internal Control Module Memory Checksum Error	Engine Control Module (ECM): Checksum Verification	• Calibration checksum incorrect • Software checksum incorrect		• 1.0 s • Continuous	• 2 DCY	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0603 Internal Control Module Keep Alive Memory (KAM) Error	Engine Control Module (ECM): Communication check	• Hardware vs. software version check during initialization failure • Internal hardware check calibration during initialization failure • Internal hardware check hardware during initialization failure		• 4.9 s • Once / DCY	• 2 DCY	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Internal hardware check time reference from microcontroller during initialization failure				
		• Internal hardware check communication between microcontroller and SDI-Driver powerstage failure		• 4320.0° CRK • Continuous		
		• Internal hardware check communication between microcontroller and SDI-Driver powerstage failure		• 360.0° CRK • Once / DCY		
		• Internal hardware check time reference from microcontroller during initialization missing		• 4320.0° CRK • Continuous		
		• Internal hardware check communication between microcontroller and SDI-Driver powerstage failed		• 4320.0° CRK • Continuous		
	Engine Control Module (ECM): Communication check	• Device 1: SPI communication with ATIC failure		• 2.0 s • Continuous		
		• Device 2: SPI communication with ATIC failure				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• SPI communication with ATIC failure				
		• SPI communication with ATIC failure			• 1 DCY	
P0606 Control Module Processor	Engine Control Module (ECM): Communication check	• EEPROM information failure		• 1.0 s. • Continuous	• 2 DCY	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
		• Decryption of NVMCrypt failed		• 1.0 s • Once / DCY		
		• Finished NVMCrypt integrity error				
		• Communication between sample software and production hardware error				
	Engine Control Module (ECM): Communication check Random Access Memory (RAM) Internal Hardware Check	• RAM error detected	• Microcontroller failure • Reset counter > 1.0 [-]	• 0.04 s • Once / DCY		
	Engine Control Module (ECM): Communication check Random Access Memory (RAM) Functional Check			• 0.01 s • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Engine Control Module (ECM): Communication check A/D Converter Function Monitoring: A/D Converter	• Diff. A/D-channel 1 vs. A/D channel 2 > 0.30 V		• 0.5 s • Continuous		
	Engine Control Module (ECM): Communication check Communication Check	• SPI communication with ATIC failed	• Time after ignition on >= 1.0 s	• 10.0 s • Continuous		
		• SPI communication with ATIC implausible				
	Engine Control Module (ECM): Communication check Electronic Throttle Control Module Function Monitoring: Torque	• Monitoring of difference between actual and set point torque value commanded on engine torque overflow > 45.0 – 350.0 Nm	• Throttle actuator commanded on	• 0.5 s • Continuous		
		• Monitoring of torque difference integration integrated engine torque > 550.00 Nms		• 0.01 s • Continuous		
	Engine Control Module (ECM): Communication check Electronic Throttle Control Module Function Monitoring: Engine Speed Limitation	• Engine speed > 1,760 RPM	• Engine speed limitation active • Injection active	• 0.5 s • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Engine Control Module (ECM): Communication check Electronic Throttle Control Module Function Monitoring: A/D Converter	• Internal check failed		• 0.5 s • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Barometric Pressure Sensor Cross Check	• Case 1: Charged engine • Diff. BARO vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure > 7.50 kPa • Case 2: Non-charged engine • Diff. BARO mean value vs. MAP mean value >= n.a. kPa • Diff. deviation BARO mean value to mean value (MAP mean value, BARO mean value, BARO @ ECM keep alive time and MAP @ ECM keep alive time) > n.a. kPa • Diff. deviation MAP mean value to mean value (MAP mean value, BARO mean value, BARO @ ECM keep alive time and MAP @ ECM keep alive time) <= n.a. kPa	• Case A: Engine stop during DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a. • For time >= 10.0 s • Case B: Engine stop @ start of DCY • Engine stopped • Vehicle speed < 1 km/h • Engine @ driving cycle n.a.	• 3.0 s • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diff. BARO vs. MAP > 7.50 kPa • Diff. BARO vs. turbocharger boost pressure > 7.50 kPa	• Engine stopped • Vehicle speed < 1 km/h • ECM keep alive-time 10.0 – 6,553.5 s • Time after engine stop >= 5.0 s • BARO sensor voltage 0.20 – 4.80 V • MAP sensor voltage 0.20 – 4.80 V • Boost pressure sensor voltage 0.20 – 4.80 V			
	Barometric Pressure Sensor Out Of Range High	• Measured barometric pressure > 115.0 kPa		• 5.0 s • Continuous		
	Barometric Pressure Sensor out Of Range Low	• Measured barometric pressure < 45.0 kPa				
	Knock Control Internal hardware check	• Knock control malfunction: Error (signal acquisition)	• Engine running	• 6.4 s • Continuous		
P0607 Control Module Performance	Barometric Pressure Sensor Short To Ground	• Barometric pressure sensor voltage < 0.20 V		• 0.5 s • Continuous	• 2 DCY	– Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
	Barometric Pressure Sensor Short To Battery Plus	• Barometric pressure sensor voltage > 4.80 V				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0634 Control Module Internal Temperature "A" Too High	Turbocharger Boost Pressure Control Valve Over Temperature	• Bypass valve driver temperature (hardware values) > 170 – 190° C	• Control valve commanded on	• 0.4 s • Continuous	• 2 DCY	If an injector circuit code exists, perform diagnosis for that code first as a short will set this fault. – Replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0638 Throttle Actuator Control Range/ Performance Bank 1	Throttle Actuator Basic Settings Adaptation Value Monitoring	• Battery voltage <= 9.04 V	• TPS adaptation (@ initial start or after detection of throttle exchange or checksum error) active	• 0.01 s • Once per lifetime	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Start Check)	• Difference between actual TPS 1 or 2 voltage and voltage reference position > 0.07 V • Difference between actual throttle and reference position > 0.503° TPS	• Throttle start check active • Accelerator pedal value < 99.90% • Engine speed < 64 RPM • Vehicle speed < 2 km/h • IAT > 5° C • ECT 5 – 120° C	• 0.01 s • Once / DCY		
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Top Limit)	• Difference between actual throttle and reference position > 0.503° TPS	• Throttle adaptation active • Accelerator pedal value < 99.90% • Engine speed < 64 RPM • Vehicle speed < 2 km/h • IAT > 5° C • ECT 5 – 120° C			
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Bottom Limit)	• Difference between actual TPS 1 or 2 voltage and voltage reference position > 0.07 V				
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Mechanical Stop Low)	• TPS 1 voltage < 0.40; > 0.80 V • Or • TPS 2 voltage < 4.20; > 4.60 V				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Throttle Actuator Basic Settings Adaptation Value Monitoring (Limp Home Position)	• Difference between actual TPS 1 or 2 voltage and voltage reference position > 0.25 V				
	Throttle Actuator Basic Settings Adaptation Value Monitoring	• Accelerator pedal value > 99.90% • Or • Engine speed > 64 RPM • Or • Vehicle speed > 2 km/h • Or • IAT @ throttle < 5° C • Or • ECT @ cylinder block < 5° C • Or • ECT @ cylinder block > 120° C	• TPS adaptation (@ initial start or after detection of throttle exchange or checksum error) active	• 0.01 s • Once per lifetime		
P0642 Sensor Reference Voltage "A" Circuit Low	ECM: 5V Supply Voltage Out Of Range Low	• Analog output 1 supply voltage < 4.62 V		• 0.2 s • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0643 Sensor Reference Voltage "A" Circuit High	ECM: 5V Supply Voltage Out Of Range High	• Analog output 1 supply voltage > 5.43 V		• 0.2 s • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0651 Sensor Reference Voltage B Circuit Open	Sensor Reference Voltage "B" Circuit/ Open	• Signal voltage deviation > +/- 0.3 V		• 0.5 s	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0652 Sensor Reference Voltage "B" Circuit Low	ECM: 5V Supply Voltage Out Of Range Low	• Analog output 2 supply voltage < 4.62 V		• 0.2 s • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0653 Sensor Reference Voltage "B" Circuit High	ECM: 5V Supply Voltage Out Of Range High	• Analog output 2 supply voltage > 5.43 V		• 0.2 s • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0657 Actuator Supply Voltage "A" Circuit/Open	Supply Voltage Relay Engine Components Open Circuit	• Output voltage, lower range >= 1.90 – 2.30 V • Output voltage, upper range (hardware values) <= 2.80 – 3.20 V	• Relay commanded off	• 1.0 s • Continuous .	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking”, page 565 .
P0658 Actuator Supply Voltage "A" Circuit Low	Supply Voltage Relay Engine Components Short To Ground	• Output voltage (hardware values) < 1.90 – 2.30 V	• Relay commanded off	• 1.0 s • Continuous	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking”, page 565 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0659 Actuator Supply Voltage "A" Circuit High	Supply Voltage Relay Engine Components Short To Battery Plus	• Output current driver stage internal value • Or • Actuator temperature (hardware values) > 175 – 195° C	• Relay commanded on	• 1.0 s • Continuous	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking", page 565 .
P0686 ECM/PCM Power Relay Control Circuit Low	Main Relay Rationality Check During Engine Off	• Sensed circuit voltage > 6.0 V	• Main relay commanded off • For time >= 0.3 s	• 0.1 s • Continuous	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking", page 565 .
	Main Relay Short To Ground	• Output voltage (hardware values) < 1.85 – 2.28 V	• Relay commanded off • For time > 40 ms	• 0.2 s • Continuous	• 2 DCY	
P0687 ECM/PCM Power Relay Control Circuit High	Main Relay Rationality Check During Engine Running	• Sensed circuit voltage < 5.0 V	• Main relay commanded on • For time >= 0.1 s	• 0.1 s • Continuous	• 2 DCY	– Check the Motronic Engine Control Module Power Supply Relay -J271-. Refer to ⇒ M3.6.22 otronic Engine Control Module Power Supply Relay J271, Checking", page 565 .
	Main Relay Short To Battery Plus	• Main relay driver temperature > 175 – 195° C • Or • Main relay output current (hardware values) driver stage internal value	• Main relay commanded on • For time >= 0.4 s	• 0.2 s • Continuous	• 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0698 Sensor Reference Voltage "C" Circuit Low	ECM: 5V Supply Voltage Out Of Range Low	• Analog output 3 supply voltage < 4.62 V		• 0.2 s • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.
P0699 Sensor Reference Voltage "C" Circuit High	ECM: 5V Supply Voltage Out Of Range High	• Analog output 3 supply voltage > 5.43 V		• 0.2 s • Continuous	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module -J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P12A1 Fuel Rail Pressure Sensor Inappropriately Low	Fuel Rail Pressure (FRP) Sensor Rationality Check Low	• Deviation lambda of controller included adaptation < -45.00 % • And • High pressure controller output > 8 mg	• Engine speed 608 – 1,088 RPM • Mass fuel flow set point 1.99 – 20.01 mg/rev • Time after change to DFI not equipped [s] • Time after engine start > 5.0 s • Engine warm-up not calibrated • Catalyst heating not calibrated • Full load not calibrated • Catalyst purge not calibrated • Lambda control closed loop • Evap purge functionality diagnosis not active • Depending on low dynamic conditions: • Fuel mass setpoint lower range > 1.99 mg/rev • For time >= 5.0 s • Fuel mass setpoint upper range < 100.32 – 172.41 mg/rev • Fuel mass setpoint gradient -1389.00 – 2.20 mg/rev • For time >= 1.2 s • Depending on canister purge: • Canister load <= 0.70 • Evap purge valve not active or closed	• 10.0 s • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P12A2 Fuel Rail Pressure Sensor Inappropriately High	Fuel Rail Pressure (FRP) Sensor Rationality Check High	• Deviation lambda of controller included adaptation > 30.00% • High pressure controller output < -10 mg	• Engine speed 608 – 1,088 RPM • Mass fuel flow set point 4.01 – 29.99 mg/rev • Time after change to DFI not equipped [s] • Time after engine start > 5.0 s • Engine warm-up not calibrated • Catalyst heating not calibrated • Full load not calibrated • Catalyst purge not calibrated • Lambda control closed loop • Evap purge functionality diagnosis not active • Depending on low dynamic conditions: • Fuel mass setpoint lower range > 1.99 mg/rev • For time >= 5.0 s • Fuel mass setpoint upper range < 100.32 – 172.41 mg/rev • Fuel mass setpoint gradient -1389.00 – 2.20 mg/rev • For time >= 1.2 s • Depending on canister purge: • Canister load <= 0.70 • Evap purge valve not active or closed	• 10.0 s • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Pressure Regulator Valve -N276-. Refer to ⇒ F3.6.14 uel Pressure Regulator Valve N276, Checking", page 549 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P1545 Throttle Actuator "A" Control Motor Circuit Range/ Performance	Throttle Actuator Out Of Range	• Control duty cycle > 98.0%	• Throttle position not at min. value • Throttle adaptation not active • Throttle actuator commanded on	• 0.7 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
	Throttle Actuator Rationality Check	• Difference between throttle position set point and throttle flap opening angle for electronic throttle control > 2.998 – 24.982° TPS	• Throttle adaptation (@ initial start or after detection of throttle exchange or checksum error) not active • Throttle actuator commanded on • Difference between throttle position set point and throttle flap opening angle <= 1.999; > -1.999° TPS	• 0.5 s • Continuous		
P1609 Crash Shut Down Was Deployed	Airbag Safety Measures Due To Crash With Airbag Activation	• Airbag(s) activated		• 0.0 s • Continuous	• 2 DCY	– Erase Engine Control Module -J623- code after proper repair of damage. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 .
P169A Vehicle in Transport Mode	ECM: Transport Mode Function Monitoring: Mode Change	• Transport mode active	• Vehicle speed < 5 km/h • Max trip mileage since initial vehicle start-up < 100.0 km • During ECM keep alive-time after ignition off • Engine speed 0 RPM • Production mode not active • For hybrid: • Drive motor off	• 0.01 s • Continuous	• 1 DCY	– Perform readiness check. Refer to ⇒ C3.2 ode", page 22 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2004 Intake Manifold Runner Control Stuck Open Bank 1	Intake Manifold Runner Control (IMRC) Actuator Stuck Open	• Signal voltage > 1.89 V • For time >= 1.5 s	• Flap commanded off • Time after engine start > 5.0 s	• 0.2 s • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve - N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .
P2006 Intake Manifold Runner Control Stuck Closed Bank 1	Intake Manifold Runner Control (IMRC) Actuator Stuck Close	• Signal voltage < 3.10 V • For time >= 1.5 s	• Flap commanded on • Time after engine start > 5.0 s	• 0.2 s • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve - N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .
P2008 Intake Manifold Runner Control Circuit/Open Bank 1	Intake Manifold Runner Control (IMRC) Actuator Open Circuit	• Output voltage lower range >= 1.92 – 2.21 V • Output voltage upper range (hardware values) <= 2.85 – 3.25 V	• Engine running • Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve - N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .
P2009 Intake Manifold Runner Control Circuit Low Bank 1	Intake Manifold Runner Control (IMRC) Actuator Short To Ground	• Output voltage (hardware values) < 1.92 – 2.21 V	• Engine running • Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve - N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2010 Intake Manifold Runner Control Circuit High Bank 1	Intake Manifold Runner Control (IMRC) Actuator Short To Battery Plus	• Power stage temperature > 160 – 200° C • Output current (hardware values) driver stage internal value	• Engine running • Actuator commanded on	• 2.0 s • Continuous	• 2 DCY	– Check the Intake Manifold Runner Control Valve - N316-. Refer to ⇒ I3.6.17 ntake Manifold Runner Control ValveN316, Checking", page 555 .
P2014 Intake Manifold Runner Position Sensor/ Switch Circuit Bank 1	Intake Manifold Runner Control (IMRC) Position Sensor Short To Ground / Open Circuit	• Intake manifold runner flap position sensor voltage < 0.20 V	• Engine start not active	• 0.04 s • Continuous	• 2 DCY	– Check the Intake Manifold Runner Position Sensor - G336-. Refer to ⇒ I3.6.18 ntake Manifold Runner Position SensorG336, Checking", page 557 .
P2017 Intake Manifold Runner Position Sensor/ Switch Circuit High Bank 1	Intake Manifold Runner Control (IMRC) Position Sensor Short To Battery Plus	• Intake manifold runner flap position sensor voltage > 4.80 V	• Engine start not active	• 0.04 s • Continuous	• 2 DCY	– Check the Intake Manifold Runner Position Sensor - G336-. Refer to ⇒ I3.6.18 ntake Manifold Runner Position SensorG336, Checking", page 557 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2088 "A" Camshaft Position Actuator Control Circuit Low Bank 1	Variable Valve Timing (VVT) Intake Actuator Short To Ground	• Output voltage (hardware values) < 1.92 – 2.21 V	• Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .
P2089 "A" Camshaft Position Actuator Control Circuit High Bank 1	Variable Valve Timing (VVT) Intake Actuator Short To Battery Plus	• Power stage temperature > 160 – 200° C • Output current (hardware values) driver stage internal value	• Actuator commanded on	• 2.0 s • Continuous	• 2 DCY	– Check the Camshaft Adjustment Valve 1 -N205-. Refer to ⇒ C3.6.2 amshaft Adjustment Valve 1N205, Checking", page 524 .
P2096 Post Catalyst Fuel Trim System Too Lean Bank 1	Fuel System Out Of Range Low	• Adaptation value < -0.05 -	• 2nd lambda control n.a. • Cat purge not active • Combustion mode change not active • Engine speed >= 704 RPM • Integrated mass for fuel in oil < 255.00 - • Choice of: • O2S rear (binary) check not active • O2S rear (binary) check finished	• 81.0 s • Continuous	• 2 DCY	Check exhaust system for leaks first and correct as necessary. – Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2097 Post Catalyst Fuel Trim System Too Rich Bank 1	Fuel System Out Of Range High	• Adaptation value > 0.05 -	• 2nd lambda control n.a. • Cat purge not active • Combustion mode change not active • Engine speed >= 704 RPM • Integrated mass for fuel in oil < 255.00 [-] • Choice of: • O2S rear (binary) check not active • O2S rear (binary) check finished	• 81.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .
P2100 Throttle Actuator "A" Control Motor Circuit/Open	Throttle Actuator Open Circuit	• Electronic throttle valve driver load resistance > 200.0 kOhm	• Difference between measured and filtered throttle position <= 119.500° TPS • Actuator commanded off	• 0.1 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P2101 Throttle Actuator "A" Control Motor Circuit Range/Performance	Throttle Actuator Over Temperature	• Electronic throttle valve driver temperature (hardware values) > 170.0 – 190.0° C	• Actuator commanded on	• 0.1 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2103 Throttle Actuator "A" Control Motor Circuit High	Throttle Actuator Short Circuit	• Electronic throttle valve driver current (hardware values) driver stage internal value	• Actuator commanded on	• 0.1 s • Continuous	• 2 DCY	– Check the Throttle Valve Control Module -GX3-. Refer to ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking", page 585 .
P2122 Throttle/Pedal Position Sensor/Switch "D" Circuit Low	Accelerator Pedal Position Sensor 1 Out Of Range Low	• Signal voltage sensor 1 < 0.39 V		• 0.3 s • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .
P2123 Throttle/Pedal Position Sensor/Switch "D" Circuit High	Accelerator Pedal Position Sensor 1 Out Of Range High	• Signal voltage sensor 1 > 4.86 V		• 0.3 s • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .
P2127 Throttle/Pedal Position Sensor/Switch "E" Circuit Low	Accelerator Pedal Position Sensor 2 Out Of Range Low	• Signal voltage sensor 2 < 0.19 V		• 0.3 s • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2128 Throttle/ Pedal Position Sensor/ Switch "E" Circuit High	Accelerator Pedal Position Sensor 2 Out Of Range High	• Signal voltage sensor 2 > 2.80 V		• 0.3 s • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .
P2138 Throttle/ Pedal Position Sensor/ Switch "D"/" E" Voltage Correlation	Accelerator Pedal Position Sensor 1 and 2 Rationality Check	• Difference between signal voltage sensor 1 and sensor 2 > 0.10 – 0.12 V		• 0.4 s • Continuous	• 2 DCY	– Check the Accelerator Pedal Module -GX2-. Refer to ⇒ A3.6.1 ccelerator Pedal Module GX2, Checking", page 522 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2177 System Too Lean Off Idle Bank 1	Fuel System Too Lean @ Part Load	• Adaptive value >= 28.0%	• Air mass > 60.00 mg/stk • (1.8L) ECT @ cylinder block > 55° C • (2.0L) ECT @ cylinder block > 60° C • IAT @ manifold > -48° C • AAT > -48° C • Lambda set point 0.92 – 1.05 [-] • Lambda control closed loop • Integrated air mass >= 5.0 – 200.0 g • Mass fuel flow 17.99 – 51.02 mg/stk • Engine speed 1,280 to 4,000 RPM • Low dynamic conditions: • Diff. engine speed vs. averaged engine speed for engine speed dynamic detection < 100 – 175 rpm • Diff. air mass vs. averaged air mass for load dynamic detection < 30.01 – 60.00 mg/rev • Diff. between reference and actual fuel pressure, high side not calibrated [kPa] • Integrated air mass > 5.0 g • Evap purge valve closed • Canister load <= 1.20 [-] • Evap purge flow at max. value	• 5.0 s • Continuous	• 2 DCY	– Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the intake system for leaks (false air) with a visual inspection. – Check the vacuum lines for leaks with a visual inspection.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Dependence on canister purge min: • Lower limit of lambda controller output n.a. • Upper limit of lambda controller output n.a. • Evap purge flow at min. value			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2178 System Too Rich Off Idle Bank 1	Fuel System Too Rich @ Part Load	• Adaptive value <= -25.0%	• Air mass > 60.00 mg/stk • (1.8L) ECT @ cylinder block > 55° C • (2.0L) ECT @ cylinder block > 60° C • IAT @ manifold > -48° C • AAT > -48° C • Lambda set point 0.92 – 1.05 [-] • Lambda control closed loop • Integrated air mass >= 5.0 – 200.0 [g] • Mass fuel flow 17.99 – 51.02 mg/stk • Engine speed 1,280 – 4,000 RPM • Low dynamic conditions: • Diff. engine speed vs. averaged engine speed for engine speed dynamic detection < 100 – 175 rpm • Diff. air mass vs. averaged air mass for load dynamic detection < 30.01 – 60.00 mg/rev • Diff. between reference and actual fuel pressure, high side not calibrated [kPa] • Integrated air mass > 5.0 g • Evap purge valve closed • Canister load <= 1.20 - • Evap purge flow at max. value	• 5.0 s • Continuous	• 2 DCY	– Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Dependence on canister purge min: • Lower limit of lambda controller output n.a. • Upper limit of lambda controller output n.a. • Evap purge flow at min. value			
P2181 Cooling System Performance	Engine Cooling System Cooling System Performance Not In The Expected Range	• Cooling system temperature too low < 61 – 76° C	• Modeled ECT > 61 – 76° C • ECT @ first start > -10° C • ECT @ first start < 42 – 57° C • Min. AAT > -10° C • At time of fault decision: • Ratio fuel cut off <= 10.20 % • Ratio maximum vehicle speed <= 14.80% • For vehicle speed > 120 km/h • Ratio start-stop time <= 16.00 % • Ratio engine load time <= 39.80 % • For air mass flow ratio with max air mass flow < 2.50 % • For air mass flow ratio with max air mass flow > 40.00 %	• 0 (Unified 430.0) s • Once / DCY	• 2 DCY	– Check the Engine Coolant Temperature Sensor -G62- and the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.8 ngine Coolant Temperature SensorG62, Checking", page 537 and ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 . – Check the Coolant Pump -V50-. Refer to the appropriate repair manual. – Check the Coolant Thermostat. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2183 Engine Coolant Temperature Sensor 2 Circuit Range/ Performance	Engine Coolant Temperature Sensor @ Radiator Outlet Cross Check	• Diff. ROT vs. IAT @ first engine start (depending on engine off time) > 20 K • Diff. ROT vs. AAT @ first engine start (depending on engine off time) > 20 K • Diff. AAT vs. IAT @ first engine start (depending on engine off time) < 20 K	• Engine off time > 360.0 min • Decrement check to ensure an cold vehicle state: • Diff. IAT vs. min. IAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 s • Diff. ROT vs. min. ROT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 s • Diff. AAT vs. min. AAT @ condition < 4.5 K • Vehicle speed > 20 km/h • For time > 20.0 s	• 100 s • Once / DCY	• 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 .
P2184 Engine Coolant Temperature Sensor 2 Circuit Low	Engine Coolant Temperature Sensor @ Radiator Outlet Short To Ground	• Sensor voltage <= 0.30 V		• 0.5 s • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 .
P2185 Engine Coolant Temperature Sensor 2 Circuit High	Engine Coolant Temperature Sensor @ Radiator Outlet Short To Battery / Open Circuit	• Sensor voltage > 4.90 V	• IAT @ throttle >= -33° C • Time after engine start > 60.0 s	• 0.5 s • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to ⇒ E3.6.9 ngine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 539 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2187 System Too Lean at Idle Bank 1	Fuel System Too Lean @ Idle	• Case 1: • Adaptive value >= 2.40 mg/stk • Case 2: • Adaptive value >= n.a. kg/h	• Air mass > 60.0 mg/stk • (1.8L) ECT @ cylinder block > 55° C • (2.0L) ECT @ cylinder block > 60° C • IAT @ manifold > -48° C • AAT > -48° C • Lambda set point 0.92 – 1.05 [-] • Lambda control closed loop • Integrated air mass >= 5.0 – 200.0 g • Vehicle speed < 6 km/h • Low dynamic conditions: • Diff. engine speed vs. averaged engine speed for engine speed dynamic detection < 100 – 175 rpm • Diff. air mass vs. averaged air mass for load dynamic detection < 30.01 – 60.00 mg/rev • Diff. between reference and actual fuel pressure, high side not calibrated kPa • Integrated air mass > 5.0 g • Fuel mass upper range < 0.00 – 17.00 mg/rev • Fuel mass lower range not calibrated [mg/rev] • Engine speed 704 – 992 rpm • Engine n.a.	• 5.0 s • Continuous	• 2 DCY	– Check the intake system visually for leaks (air not metered through the MAF). – Check the vacuum lines for leaks with a visual inspection. – Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Evap purge valve closed • Canister load <= 1.20 [-] • Evap purge flow at max. value • Depending on canister purge min: • Lower limit of lambda controller output n.a. • Upper limit of lambda controller output n.a. • Evap purge flow at min. value			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2188 System Too Rich at Idle Bank 1	Fuel System Too Rich @ Idle	• Case 1: • Adaptive value <= 2.40 mg/stk • Case 2: • Adaptive value <= n.a. kg/h	• Air mass > 60.0 mg/stk • (1.8L) ECT @ cylinder block > 55° C • (2.0L) ECT @ cylinder block > 60° C • IAT @ manifold > -48° C • AAT > -48° C • Lambda set point 0.92 to 1.05 [-] • Lambda control closed loop • Oil dilution not detected • Integrated air mass >= 5.0 – 200.0 g • Vehicle speed < 6 km/h • Low dynamic conditions • Diff. engine speed vs. averaged engine speed for engine speed dynamic detection < 100 – 175 rpm • Diff. air mass vs. averaged air mass for load dynamic detection < 30.01 – 60.00 mg/rev • Diff. between reference and actual fuel pressure, high side not calibrated [kPa] • Integrated air mass > 5.0 g • Mass fuel flow lower range not calibrated [kPa] • Mass fuel flow upper range < 0.00 – 17.00 mg/stk	• 5.0 s • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor -G247-. Refer to ⇒ F3.6.15 uel Pressure Sensor G247, Checking", page 551 . – Check the Fuel Injectors -N30, N31, N32, N33, -. Refer to ⇒ F3.6.13 uel Injector, Checking", page 547 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 . – Check the EVAP Canister Purge Regulator Valve 1 -N80-. Refer to ⇒ E3.6.11 VAP Canister Purge Regulator Valve 1 N80, Checking", page 542 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Engine speed 704 – 992 RPM • Engine n.a. • Evap purge valve closed • Canister load <= 1.20 [-] • Evap purge flow at max. value • Depending on canister purge min: • Lower limit of lambda controller output n.a. • Or • Upper limit of lambda controller output n.a. • Evap purge flow at min. value			
P2195 O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1	Oxygen Sensors Front Rationality Check - upstream and downstream oxygen sensor signal	• Lambda value > 1.15 [-] • O2S signal rear >= 0.88 V	• O2S front ready • O2S rear ready • ECT @ cylinder block >= -48° C • MAF > 15.0; < 300.0 kg/h • Catalyst purge not active • Engine speed > 1,152 RPM • Limited dynamic conditions active • Exhaust gas temperature at O2S rear > -273; < 800° C • Combustion mode change not active	• 72.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking”, page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2196 O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 1	Oxygen Sensors Front Rationality Check - upstream and downstream oxygen sensor signa	• Lambda value < 0.85 [-] • And • O2S signal rear <= 0.25 [V]	• O2S front ready • O2S rear ready • ECT @ cylinder block >= -48° C • MAF > 15.0; < 300.0 kg/h • Catalyst purge not active • Engine speed > 1,152 RPM • Limited dynamic conditions active • Exhaust gas temperature at O2S rear > -273; < 800° C • Combustion mode change not active	• 72.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2237 O2 Sensor Positive Current Control Circuit/Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Pump Voltage (VIP)	• Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 1.20 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) <= 1.20 V • Choice of: • Nernst voltage (VN) > 4.40 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 2.35 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) < -2.35 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.60 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) < -0.10 V • Pump current driver stage internal value • measurement O2S front label resistor > n.a. Ohm	• O2S front (linear) ready • O2S ceramic temperature > 785° C • For time >= 10.0 s	• 2.3 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2243 O2 Sensor Reference Voltage Circuit/ Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Nernst Voltage (VN)	• Diff. pump voltage (VIP) vs. virtual ground voltage (VG) <= 1.20 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.20 V • Choice of: • Nernst voltage (VN) > 4.40 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 2.35 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) < -2.35 V • Or • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.60 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) < -0.10 V • Pump current driver stage internal value • measurement O2S front label resistor > n.a. Ohm	• O2S front (linear) ready • O2S ceramic temperature > 785° C • For time >= 10.0 s	• 2.3 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2251 O2 Sensor Negative Current Control Circuit/Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Virtual Ground (VG)	• Nernst voltage (VN) > 4.40 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 2.35 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) < -2.35 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.60 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) < -0.10 V • Or • Pump current driver stage internal value • Measurement O2S front label resistor > n.a. Ohm • Choice of: • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) <= 1.20 V • Diff. nernst voltage (VN) vs. virtual ground voltage (VG) <= 1.20 V • Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 1.20 V	• O2S front (linear) ready • O2S ceramic temperature > 785° C • For time >= 10.0 s	• 2.3 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking”, page 572 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.20 V				
P2261 Turbocharger/Supercharger Bypass Valve "A" - Mechanical	Turbocharger Bypass (TCBY) Functional Check: Stuck Close	• Case 1: • Integrated boost pressure deviation between PUT and filtered PUT n.a. [kPa] • Case 2: • Counter PUT crosses filtered PUT > 5.00 [-] • Operational sequence for incrementing counter in case 2: • Positive difference between PUT and filtered PUT > 0.80 kPa • Negative difference between PUT and filtered PUT < -2.00 kPa	• External torque request not demanded • IAT @ throttle > -11° C • Barometric pressure > 73.0 kPa • Intake overpressure protection not active • Active turbocharger protection leading to opening of the wastegate not active • Activations conditions: • Recirculation actuator position setpoint 100.0% • Time since last valve closed activation > 1,200 ms. • Gradient accelerator pedal value <= -97.70% / sec. • Max boost pressure variation <= 50.0 kPa	• 0.1 s • Continuous	• 2 DCY	– Check the Turbocharger Recirculation Valve -N249-. Refer to ⇒ T3.6.32 urbocharger Recirculation ValveN249, Checking”, page 588 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2263 Turbocharger/Supercharger Boost System Performance	Turbocharger (TC) Position Sensor adaptation monitoring: Functional Check	• No adaptation of boost pressure actuator sensor in actual driving cycle (no previous adaptation occurred)		• 0.0 s • Once / DCY	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2270 O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	Oxygen Sensors Rear Signal Range Check	• Case 1: • Max. O2S rear voltage < 0.87 V • Oxygen load during Peak Max detection > 4.0 g • Case 2: • Max. O2S rear voltage < 0.87 V • Oxygen load during Peak Max detection > 3.8 g • Counter in case of suspected peak max error > 5,000.00 [-]	• General conditions • Vehicle speed >= 10 km/h • Barometric pressure n.a. • Catalyst overheating protection not active • O2S rear ready • O2S front ready • O2S front pump current valid • Internal resistance O2S rear <= 700.00 Ohm • Time after a catalyst purge phase >= 0.02 s • O2S heater rear active • Integrated heat energy >= 1,600.0 – 3,000.0 kJ • Or • Time after engine start > 230.0 – 1,000.0 s • (1.8L) Engine speed 1,280 – 3,008 RPM • (2.0L) Engine speed 1,344 – 3,008 RPM • Lambda control value < 50.0% • Deviation of lambda controller output @ start diagnosis < 10.00 % • Deviation of lambda controller output during diagnosis < 8.00 – 15.00 [-] • Fast trim control not calibrated • Proportional part of secondary fuel	• 86.5 s • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to ⇒ Ö3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			control loop < 0.25 [-] • Coasting function not active • Lambda adaptation not active • Valve lift not equipped • Temperature conditions • ECT > 60° C • IAT > -48° C • Modeled catalyst temperature once after engine start > 550° C • Modeled catalyst temperature @ start of diagnosis 500° C • Modeled catalyst temp. extended range 470 – 730° C • Integrated MAF, catalyst temp. conditions fulfilled > n.a. g • Difference between dynamic and stationary catalyst temp. -254.0 – 254.0 K • Difference between dynamic and stationary catalyst temp. extended range -304.0 – 304.0 K • Modeled catalyst temperature @ start > 550° C • Modeled exhaust gas temperature at O2S rear <= 1,201° C • Air mass flow conditions • MAF per cylinder 40.0 – 130.0 kg/h • MAF per cylinder extended range			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			35.00 – 135.00 kg/h • Load conditions: • Air mass setpoint 125.01 – 580.00 mg/rev • Engine load not calibrated [%] • Accelerator pedal value not calibrated [%] • For time not calibrated [s] • Low dynamic conditions: • Dynamic engine speed < 20 rpm • Dynamic air mass < 25.01 mg/rev • Dynamic lambda controller output < 20.00 % • Integrated air mass after dynamic conditions are fulfilled > 20.0 g • Evap purge conditions: Case 1 • Evap purge valve not calibrated • Case 2 • Canister load calculation not calibrated • Evap purge flow not calibrated • Case 3 • Canister load not calibrated [-] • Evap purge flow not calibrated • Close the gap conditions: • O2S rear voltage @ diagnosis start >= 0.55 V • Integrated air mass @ start di-			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			agnosis not calibrated • O2S front dynamic diagnosis separate not active			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2271 O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 2	Oxygen Sensors Rear Signal Range Check	• Case 1: • Min. O2S rear voltage > 0.25 V • Oxygen load during Peak Min detection > 2.6 g • Case 2: • Min. O2S rear voltage > 0.25 V • Oxygen load during Peak Min detection > 2.5 g • Counter in case of suspected peak min error > 5,000.00 [-]	• General conditions • Vehicle speed >= 10 km/h • Barometric pressure n.a. • Catalyst overheating protection not active • O2S rear ready • O2S front ready • O2S front pump current valid • Internal resistance O2S rear <= 700.00 Ohm • Time after a catalyst purge phase >= 0.02 s • O2S heater rear active • Integrated heat energy >= 1,600.0 – 3,000.0 kJ • Or • Time after engine start > 230.0 – 1,000.0 s • (1.8L) Engine speed 1,280 – 3,008 RPM • (2.0L) Engine speed 1,344 – 3,008 RPM • Lambda control value < 50.0% • Deviation of lambda controller output @ start diagnosis < 10.00 % • Deviation of lambda controller output during diagnosis < 8.00 – 15.00 [-] • Fast trim control not calibrated • Proportional part of secondary fuel	• 86.5 s • Once / DCY	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to ⇒ O3.6.24 xygen Sensor 1 After Catalytic ConverterGX7, Checking", page 569 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			control loop < 0.25 [-] • Coasting function not active • Lambda adaptation not active • Valve lift not equipped • Temperature conditions • ECT > 60° C • IAT > -48° C • Modeled catalyst temperature once after engine start > 550° C • modeled catalyst temperature @ start of diagnosis 500° C • Modeled catalyst temp. extended range 470 – 730° C • Integrated MAF, catalyst temp. conditions fulfilled > n.a. g • Difference between dynamic and stationary catalyst temp. -254.0 – 254.0 K • Difference between dynamic and stationary catalyst temp. extended range -304.0 – 304.0 K • Modeled catalyst temperature @ start > 550° C • Modeled exhaust gas temperature at O2S rear <= 1,201° C • Air mass flow conditions • MAF per cylinder 40.0 – 130.0 kg/h • MAF per cylinder extended range			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			35.00 – 135.00 kg/h • Load conditions: • Air mass setpoint 125.01 – 580.00 mg/rev • Engine load not calibrated [%] • Accelerator pedal value not calibrated [%] • For time not calibrated [s] • Low dynamic conditions: • Dynamic engine speed < 20 [rpm] • Dynamic air mass < 25.01 [mg/rev] • Dynamic lambda controller output < 20.00 % • Integrated air mass after dynamic conditions are fulfilled > 20.0 g • Evap purge conditions: Case 1 • Evap purge valve not calibrated • Case 2 • Canister load calculation not calibrated • Evap purge flow not calibrated • Case 3 • Canister load not calibrated [-] • Evap purge flow not calibrated • Close the gap conditions: • O2S rear voltage @ diagnosis start >= 0.55 V • Integrated air mass @ start di-			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			agnosis not calibrated • O2S front dynamic diagnosis separate not active			
P2279 MAP /MAF - Throttle Position Correlation	Intake Air System Rationality Check	• Ratio adapted turbocharger boost pressure and actual turbocharger boost pressure > 35.0% • Lambda correction included controller and adaptation -50.0 – 50.0% • Lambda controller active	• Intake manifold modeled adaptation active (by turbocharger boost pressure) • Throttle position > 4.50° TPS • Engine speed 1,216 – 6,000 RPM • Pressure quotient @ throttle 0.63 – 0.90 [-] • Engine running • Fast throttle adaptation finished • MAP gradient -200.0 – 200.0 kPa/sec. • Fuel cut off not active • Time after engine start > 5.0 s • Boost pressure < 135.0 kPa • BARO 73.00 – 107.50 kPa	• 5.0 s • Continuous	• 2 DCY	Check for air leaks between MAF and throttle body, oil fill cap not tight or oil dipstick not seated in tube. Also any engine gaskets that can cause additional air to enter the crankcase can set this fault as the PCV system is not metered. If a vacuum leak or crankcase gasket sealing is at cause, the idle may be rough or unstable.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Throttle opening area correction included controller and adaptation > 50.0 % • Lambda correction included controller and adaptation -28.0 – 28.0 % • Lambda controller active	• Intake manifold modeled adaptation active (by turbocharger boost pressure) • Throttle position 0.000 – 100.003° TPS • Engine speed 576 – 3,008 RPM • Pressure quotient @ throttle 0.27 – 0.60 [-] • Fast throttle adaptation finished • MAP gradient -200.0 – 200.0 kPa/sec. • Fuel cut off not active • Time after engine start > 5.0 s • Turbocharger boost pressure < 135.00 kPa • BARO 73.00 – 107.50 kPa			
P2300 Ignition Coil A Primary Control Circuit Low	Ignition Coils Short To Ground	• Output current in ON state (hardware values) driver stage internal value	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2301 Ignition Coil A Primary Control Circuit High	Ignition Coils Short To Battery Plus	• Diagnosis_by_inactive_low side switch in ATIC: • Output voltage in OFF state (hardware values) > 4.95 – 5.285 V	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded off	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diagnosis_by_inactive_low side switch in ATIC: • Output temperature from ATIC in ON state > 160.0 – 200.0° C • Or • Output current in ON state (hardware values) driver stage internal value	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded on			
P2302 Ignition Coil "A" Secondary Circuit	Ignition Coils Open Circuit	• Output voltage in OFF state lower range >= 1.92 – 2.21 V • Output voltage in OFF state upper range (hardware values) <= 2.85 – 3.25 V •	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N70-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2303 Ignition Coil B Primary Control Circuit Low	Ignition Coils Short To Ground	• Output current in ON state (hardware values) driver stage internal value	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N127-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2304 Ignition Coil B Primary Control Circuit High	Ignition Coils Short To Battery Plus	• Diagnosis_by_inactive_low side switch in ATIC: • Output voltage in OFF state (hardware values) > 4.95 – 5.285 V	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded off	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage - N127-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
		• Diagnosis_by_inactive_low side switch in ATIC: • Output temperature from ATIC in ON state > 160.0 – 200.0° C • Or • Output current in ON state (hardware values) driver stage internal value	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded on			
P2305 Ignition Coil "B" Secondary Circuit	Ignition Coils Open Circuit	• Output voltage in OFF state lower range >= 1.92 – 2.21 V • Output voltage in OFF state upper range (hardware values) <= 2.85 – 3.25 V •	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage - N127-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2306 Ignition Coil C Primary Control Circuit Low	Ignition Coils Short To Ground	• Output current in ON state (hardware values) driver stage internal value	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage - N291-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking”, page 553 .
P2307 Ignition Coil C Primary Control Circuit High	Ignition Coils Short To Battery Plus	• Diagnosis_by_inactive_low side switch in ATIC: • Output voltage in OFF state (hardware values) > 4.95 – 5.285 V	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded off	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage - N291-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking”, page 553 .
		• Diagnosis_by_inactive_low side switch in ATIC: • Output temperature from ATIC in ON state > 160.0 – 200.0° C • Or • Output current in ON state (hardware values) driver stage internal value	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded on			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2308 Ignition Coil "C" Secondary Circuit	Ignition Coils Open Circuit	• Output voltage in OFF state lower range >= 1.92 – 2.21 V • Output voltage in OFF state upper range (hardware values) <= 2.85 – 3.25 V •	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage - N291-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2309 Ignition Coil D Primary Control Circuit Low	Ignition Coils Short To Ground	• Output current in ON state (hardware values) driver stage internal value	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage - N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P2310 Ignition Coil D Primary Control Circuit High	Ignition Coils Short To Battery Plus	• Diagnosis_by_inactive_low side switch in ATIC: • Output voltage in OFF state (hardware values) > 4.95 – 5.285 V	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded off	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage - N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Diagnosis_by_inactive_low side switch in ATIC: • Output temperature from ATIC in ON state > 160.0 – 200.0° C • Or • Output current in ON state (hardware values) driver stage internal value	• Engine speed > 512 RPM • Engine stop not active • Actuator commanded on			
P2311 Ignition Coil "D" Secondary Circuit	Ignition Coils Open Circuit	• Output voltage in OFF state lower range >= 1.92 – 2.21 V • Output voltage in OFF state upper range (hardware values) <= 2.85 – 3.25 V •	• Engine speed > 512 RPM • ECT @ cylinder block > -30° C • Engine stop not active	• 0.8 s • Continuous	• 2 DCY	– Check the Ignition Coil with Power Output Stage -N292-. Refer to ⇒ I3.6.16 gnition Coils With Power Output Stage , Checking", page 553 .
P240A EVAP System Leak Detection Pump Heater Control Circuit/Open	Evaporative Emission (EVAP) Leak Detection Pump (LDP) Open Circuit	• Output voltage lower range 1.85 – 2.28 V • Output voltage upper range (hardware values) 2.75 – 3.36 V	• Actuator commanded off	• 0.3 s • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P240B EVAP System Leak Detection Pump Heater Control Circuit Low	Evaporative Emission (EVAP) Leak Detection Pump (LDP) Short To Ground	• Output voltage (hardware values) < 1.85 – 2.28 V	• Actuator commanded off	• 0.3 s • Continuous	• 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P240C EVAP System Leak Detection Pump Heater Control Circuit High	Evaporative Emission (EVAP) Leak Detection Pump (LDP) Short To Battery Plus	• Actuator temperature > 155 – 185° C • Or • Output current (hardware values) driver stage internal value	• Actuator commanded ON	• 0.3 s • Continuous	• 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P2400 EVAP System Leak Detection Pump Control Circuit/ Open	Evaporative Emission (EVAP) Leak Detection Pump (LDP) Open Circuit	• Output voltage (hardware values) 1.85 – 2.28 V	• Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the Leak Detection Pump - V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2401 EVAP System Leak Detection Pump Control Circuit Low	Evaporative Emission (EVAP) Leak Detection Pump (LDP) Short To Ground	• Output voltage (hardware values) < 1.85 – 2.28 V	• Actuator commanded off	• 2.0 s • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P2402 EVAP System Leak Detection Pump Control Circuit High	Evaporative Emission (EVAP) Leak Detection Pump (LDP) Short To Battery Plus	• Actuator temperature > 155 – 185° C • Or • Output current (hardware values) driver stage internal value	• Actuator commanded ON	• 2.0 s • Continuous	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .
P2407 EVAP System Leak Detection Pump Sense Circuit Intermittent/Erratic	Evaporative Emission (EVAP) System Signal Check	• Pump current oscillation > 1.5 mA • Number of aborted leak measurements due to pump current oscillations > 0.00 [-]	• Time after measurement start (during ECM keep alive-time) > 4.0 s	• 624.0 s • Once / DCY	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2414 O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	Oxygen Sensors Front Rationality Check	• Pump current correction (nernstcell) > 1.2 mA	• O2S front ready • Fuel cut off not active • injection mode change (DFI/ MFI) not active • Depending on engine state: • Engine part load • Engine full load • Engine idle • For time >= 3.0 s	• 10.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to ⇒ O3.6.25 xygen Sensor 1 Before Catalytic ConverterGX10, Checking", page 572 .
P2450 EVAP System Switching Valve Performance/ Stuck Open	Evaporative Emission (EVAP) System Rationality Check	• Time after measurement start > 2.0; < 2.5 s • Drop of evap pump current < 3.0 mA	• Barometric pressure > 73.00 kPa • AAT 4 - 38° C • ECT @ start >= 4° C • vehicle speed < 1 km/h • Time since engine start in preceding DCY >= 600.0 s • Difference between ECT and AAT @ start not calibrated K • Engine stop (during ECM keep alive-time) • Air bag not activated • Propulsion off time >= 21600.0 s	• 0.5 s • Once / DCY	• 2 DCY	– Check the Leak Detection Pump -V144-. Refer to ⇒ L3.6.21 eak Detection Pump V144 / DM – TL (Tank Leak Diagnostic Module), Checking", page 563 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2563 Turbocharger Boost Control Position Sensor "A" Circuit Range/ Performance	Turbocharger (TC) Position Sensor adaptation monitoring: Functional Check	• Boost pressure actuator sensor voltage > 4.52; < 2.73 V	• Gradient of boost pressure >= -2.98 % / s	• 0.3 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .
P2564 Turbocharger Boost Control Position Sensor "A" Circuit Low	Turbocharger Position Sensor Short To Ground / Open Circuit	• Turbocharger boost control position sensor voltage < 0.20 V		• 0.5 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2565 Turbocharger Boost Control Position Sensor "A" Circuit High	Turbocharger Position Sensor Short To Battery Plus	• Turbocharger boost control position sensor voltage > 4.80 V		• 0.5 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor - G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .
P2610 ECM/PCM Engine Off Timer Performance	Engine Off Time Rationality Check	• Difference between engine-off-time and ECM keep alive-time > 12.0 s	• Monitor Entry Conditions: • ECM keep alive time active • Delay time >= 1.0 s • Last ECM activation time >= 2.0 s • Time after last engine stop < 48 h • Case 1: • For time (after entry conditions fulfilled) >= 65.0 s • Case 2: • For time (after entry conditions fulfilled) < 65.0 s • Ignition key transition off to on	• 10.0 ms • Once / DCY	• 2 DCY	– Replace the Engine Control Module - J623-. Refer to the appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Difference between engine-off-time and ECM keep alive-time >= 12.0 s	• Time after engine stop < 86,400.0 s • Engine off time plausible • Engine off time monitoring not finished • Engine off time signal valid • Time after reset < 2.0 s • Case 1: • Engine off timer n.a. • Engine off time n.a. • Case 2: • ECM internal timer active • SPI communication failure after reset detected	• 0.01 s • Once / DCY		
	Engine Off Time ECM Internal Timer Check	• ECM internal timer failure • ECM internal timer signal not calibrated • ECM internal timer not calibrated • time after last engine stop not calibrated [h]	• SPI initialization finished	• 1.3 s • Continuous	• 2 DCY	
P3043 Fuel pump mechanical malfunction	COM: Fuel Pump Control Module (FPCM) communication with FPCM	• FP signal: ROM / RAM failure feedback >= 3.00 [-]	• Engine on	• 13.8 s • continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking”, page 544 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P3044 Fuel Pump "A" Control Circuit Low	COM: Fuel Pump Control Module (FPCM) communication with FPCM	• FP signal: overcurrent failure feedback >= 3.00 [-]	• Engine on	• 19.8 s • continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .
P3045 Fuel pump electronics Faulty	COM: Fuel Pump Control Module (FPCM) Communication With FPCM	• FP signal: rotary failure feedback >= 3.00 [-]	• Engine on	• 22.8 s • continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .
P3073 Fuel Pump "A" Control Circuit/ Open	COM: Fuel Pump Control Module (FPCM) Communication With FPCM	• FP signal: power amplifier failure feedback >= 3.00 [-]	• Engine on	• 16.8 s • continuous	• 2 DCY	– Check the Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-. Refer to ⇒ F3.6.12 uel Delivery UnitGX1 / Fuel Pump Control ModuleJ538, Checking", page 544 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P334A Charge Pressure Actuator Electrical Error	Turbocharger Boost Pressure Control Short Circuit	• Bypass valve driver current (hardware values) driver stage internal value	• Boost pressure actuator controller active	• 0.4 s • Continuous	• 2 DCY	– Check the Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to ⇒ C3.6.6 harge Air Pressure Actuator V465 / Charge Air Pressure Actuator Position Sensor G581, Checking", page 533 .
U0001 High Speed CAN Communication Bus	CAN: Powertrain BUS Reading Back Sent Message Powertrain	• Message no feedback	• Time after ignition on 0.5 s	• 0.5 s • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0002 High Speed CAN Communication Bus Performance	CAN: Powertrain BUS communication check	• General CAN timeout >= 0.4 sec.	• Time after ignition on >= 0.5 s	• 0.5 s • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0101 Lost Communication with TCM	CAN: Transmission Control Module (TCM) Communication With TCM	• Received CAN message no message	• Time after ignition on >= 0.5 s	• 0.5 s • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0121 Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN: Brake System Control Module (BSCM) Communication With BSCM	• Received CAN message no message	• Time after ignition on >= 0.5 s	• 0.5 s • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0140 Lost Communication With Body Control Module	CAN: Body Control Module (BCM) Communication With BCM	• Received CAN message no message	• Time after ignition on >= 0.5 s	• 0.5 s • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0146 Lost Communication With Gateway A	COM: Gateway Communication With Gateway	• Received CAN message no message	• Time after ignition on >= 0.5 s	• 0.5 s • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .
U0155 Lost Communication With Instrument Panel Cluster (IPC) Control Module	COM: Instrument Panel Cluster (IPC) communication with IPC	• Received CAN message no message	• Time after ignition on >= 0.5 s	• 0.5 s • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0302 Software Incompatibility with Transmission Control Module	Engine Control Module (ECM): Coding Code Check Of ECM Concerning TCM	• Received A/T vehicle data from TCM, TCM signal		• 50.0 s • Continuous	• 2 DCY	– Check for software updates and TSB's. Reprogram as necessary. If none are found, replace the DSG Transmission Mechatronic -J743-. Refer to the appropriate repair manual.
U0323 Software Incompatibility With Instrument Panel Control Module	COM: Ambient Air Temperature (AAT) Sensor communication with IPC	• Ambient temperature sensor: source configuration failure	• Time after ignition on > 1.2 s	• 1.0 s • Continuous	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ O3.6.23 utside Air Temperature SensorG17, Checking", page 568 .
U0402 Invalid Data Received From TCM	COM: Transmission Control Module (TCM) Communication With TCM	• Received data from TCS, implausible message	• Time after ignition on >= 0.5 s	• 0.5 s • Continuous	• 2 DCY	– Check for software updates and TSB's. Reprogram as necessary. If none are found, replace the DSG Transmission Mechatronic -J743-. Refer to the appropriate repair manual.
U0415 Invalid Data Received From Anti-Lock Brake	CAN: Vehicle Speed Sensor CAN Communication With Vehicle Speed Sensor	• Speed sensor signal: sensor error 327.42 km/h • Speed sensor signal: initialization error 327.08 km/h	• Time after ignition on > 500 ms.	• 0.5 s • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking", page 528 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
System (ABS) Control Module		• Speed sensor signal: low voltage error 327.25 km/h				
		• Speed sensor signal: range error 326.40 – 327.07 km/h • Or • Speed sensor signal: range error 327.09 – 327.24 km/h • Or • Speed sensor signal: range error 327.26 – 327.41 km/h • Or • Speed sensor signal: range error 327.43 – 327.67 km/h				
	CAN: Brake System Control Module (BSCM) CAN Communication With Brake Unit	• Received data from TCS implausible message	• Time after ignition on >= 0.5 s			
	Vehicle Speed Rationality Check High	• Vehicle speed > 325 km/h		• 2.0 s • Continuous	• 2 DCY	
U0423 Invalid Data Received From Instrument Panel Cluster	CAN: Ambient Air Temperature Sensor CAN Communication With Ambient Air Temperature Sensor	• Ambient air temperature signal failure	• Time after ignition on > 0.5 s • Engine running	• 0.6 s • Continuous	• 2 DCY	– Check the Outside Air Temperature Sensor -G17-. Refer to ⇒ Ο3.6.23 utside Air Temperature SensorG17, Checking”, page 568 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
Control Module	CAN: Ambient Air Temperature Sensor Communication With Instrument Cluster Module	• Ambient temperature sensor: source in reset failure	• Time after ignition on > 1.2 s	• 2.0 s • Continuous		
	CAN: Instrument Cluster CAN Communication With Instrument Cluster Module	• Received data from Instrument Cluster implausible message	• Time after ignition on > 0.5 s	• 0.5 s • Continuous		
U0447 Invalid Data Received From Gateway "A"	CAN: Gateway CAN Communication With Gateway	• Received data from Gateway implausible message	• Time after ignition on >= 0.5 s	• 0.5 s • Continuous	• 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ T3.6.4 erminal Resistance, Checking”, page 528 .
U1103 Production mode active	Engine Control Module (ECM): Production Mode Function Monitoring: Mode Change	• Production mode active	• Vehicle speed < 5 km/h • Max trip mileage since initial vehicle start-up < 100 km • During ECM keep alive-time after ignition off • Engine speed 0 RPM • For hybrid: drive motor off	• 0.01 s • Continuous	• 1 DCY	– Vehicle in production mode. Refer to appropriate repair manual for resolution.

3.5 Transmission DTC Tables

- ⇒ T3.5.1 ransmission Control Module, 6 speed, 02E (2013 – 2015 MY)”, page 447
- ⇒ T3.5.2 ransmission Control Module 09G (2016 MY)”, page 476
- ⇒ T3.5.3 ransmission Control Module 6 speed, 02E (2016 MY)”, page 492

3.5.1 Transmission Control Module, 6 speed, 02E (2013 – 2015 MY)

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0219	Engine Overspeed Condition	• signal range check	• rotational speed of gearbox input shaft exceed a maximum value	• rotational speed> 12000 rpm	• terminal 15 voltage > 4 V for more than 500 ms	• 500 ms	• 2 driving cycles
P0501	Vehicle Speed Sensor "A" Circuit Range/ Performance	• plausibility check	• calculate the speed of input shaft with the gear ratio of engaged gear on input shaft and the output shaft speed. compare the calculated speed with measured speed of input shaft	• speed difference magnitude > 330 rpm (output speed = 500rpm)… 100 rpm (output speed>=2000 rpm)	• gear on input shaft engaged • no valid CAN output speed information • output speed > 25 rpm OR speed of input shaft > 1000 rpm • terminal 15 voltage >4 V for more than 500 ms • battery voltage >9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 300 ms	• 2 driving cycles
P0701	Transmission Control System Range/ Performance	• signal range check	• travel sensor voltage gearshift fork 1/3 out of plausibility range	• voltage < 100 mV OR • voltage > 4900mV		• 300 ms	• 2 driving cycles
			• travel sensor voltage gearshift fork 2/4 out of plausibility range				
			• travel sensor voltage gearshift fork 5/N out of plausibility range				

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• travel sensor voltage gearshift fork 6/R out of plausibility range				
P0702	Transmission Control System Electrical	• plausibility check	• In spite of cut off Common High-side Switch 1 a measurable current. In spite of turned on Common High-side Switch 1 no current measurable.	• CHS1 cut off and CHS1-Current> 40 mA CHS1 turned on and CHS1-Current< 200 mA	• one-time after reset • terminal 15 voltage < 18 V • no short-circuit current check failure of CHS1 • common high-side switch 1 voltage >9.2V • gearbox subsystem 1 active • common high-side switches not deactivated by module 2	• 300 ms	• 2 driving cycles
			• In spite of cut off Common High-side Switch 2 a measurable current. In spite of turned on Common High-side Switch 2 no current measurable.	• CHS2 cut off and CHS2-Current> 40 mA CHS2 turned on and CHS2-Current< 200 mA	• one-time after reset • terminal 15 voltage < 18 V • no short-circuit current check failure of CHS2 • common high-side switch 2 voltage >9.2V • gearbox subsystem 2 active • common high-side switches not deactivated by module 2		

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• In spite of cut off Common High-side Switch 3 a measurable current. In spite of turned on Common High-side Switch 3no current measurable.	• CHS3 cut off and CHS3-Current> 40 mA CHS3 turned on and CHS3-Current< 200 mA	• one-time after reset • terminal 15 voltage < 18 V • no short-circuit current check failure of CHS3 and main pressure solenoid valve • common high-side switch 1 and 2 voltage >9.2V • common high-side switches not deactivated by module 2		
P0717	Input/ Turbine Shaft Speed Sensor "A" Circuit No Signal	• plausibility check	• calculate the speed of input shaft 1 with the gear ratio of engaged gear on input shaft 1 and the output shaft speed. compare the calculated speed with measured speed of input shaft 1	• speed difference magnitude> 330 rpm (output speed = 500rpm)… 100 rpm (output speed>=2000 rpm)	• gear engaged on input shaft 1 • valid CAN output speed information • speed of input shaft 1 < 25 rpm • output speed > 25 rpm • terminal 15 voltage >4 V for more than 500 ms • battery voltage >9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 900 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• calculate the speed of input shaft 2 with the gear ratio of engaged gear on input shaft 2 and the output shaft speed. compare the calculated speed with measured speed of input shaft 2		• gear engaged on input shaft 2 • valid CAN output speed information • speed of input shaft 2 < 25 rpm • output speed > 25 rpm • terminal 15 voltage >4 V for more than 500 ms • battery voltage >9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms		
P0729	Gear 6 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage sixth gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• integral > 125	• no slipping point adaptation of clutch 2 • multiplexer position = 0 • control gearshift fork valve 3 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 2	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0731	Gear 1 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage first gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1	• integral > 125	• no slipping point adaptation of clutch 1 • multiplexer position = 0 • control gearshift fork valve 1 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 1	• 2 driving cycles
P0732	Gear 2 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage second gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• integral > 125	• no slipping point adaptation of clutch 2 • multiplexer position = 1 • control gearshift fork valve 3>= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 2	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0733	Gear 3 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage third gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1	• integral > 125	• no slipping point adaptation of clutch 1 • multiplexer position = 0 • control gearshift fork valve 2 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 1	• 2 driving cycles
P0734	Gear 4 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage fourth gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• integral > 125	• no slipping point adaptation of clutch 2 • multiplexer position = 1 • control gearshift fork valve 4 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 2	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0735	Gear 5 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage fifth gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1	• integral > 125	• no slipping point adaptation of clutch 1 • multiplexer position = 1 • control gearshift fork valve 1>= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 1	• 2 driving cycles
P0736	Reverse Incorrect Ratio	• unable to disengage the reverse gear	• gearshift fork of reverse gear stays in shifted position in spite of control to disengage	• gearshift fork position < synchronizing point reverse gear - 10% synchronizing point measured by a basic adjustment (reverse gear stays in shifted position) control gearshift fork	• control safety valve 2 (ON) >= 20% • multiplexer position = 0 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• synchronizing detection while the gearshift fork was controlled to engage reverse gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• integral > 125	• no slipping point adaptation of clutch 1 • multiplexer position = 0 • control gearshift fork valve 4 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms		
P0746	Pressure Control Solenoid "A" Performance/ Stuck Off	• pressure integral monitoring	• integral of actual pressure minus desired pressure minus drain exceeds a maximum value	• pressure integral>= 0,1 bar*s	• desired pressure <= adapted clutch slipping point + 1 bar • standing vehicle with accelerator pedal < 0.1% • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• open-circuit check	• desired valve current of clutch 1 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold	• desired current> 350 mA actual current< 50 mA	• common high-side switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common high-side switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm		
P0747	Pressure Control Solenoid "A" Stuck On	• pressure buildup monitoring	• the number of successive pressure buildup failure of clutch 1 reaches a maximum value	• counter > 2	• engaged gear on input shaft 1 • desired pressure >adapted clutch slipping point – 0.2 bar • output speed < 200 rpm • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• short-circuit current check	• comparison of actual valve current with desired valve current of clutch 1	• actual current>desired current and (actual current-desired current)> 200 mA for more than 200 ms	• common high-side switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common high-side switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 200 ms	

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0751	Shift Solenoid "A" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 – actual current of clutch 1) at switching point of control gearshift fork valve 1 with residual current at permanent control of control gearshift fork valve 1	• difference of residual current<= 200 mA (supply voltage at common high-side 1=7 V) .. 450 mA (supply voltage at common high-side 1=13 V)	• common high-side switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common high-side switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor change of safety valve 1 (control of safety valve 1 is stable) <= 5% • duty factor change of gearshift fork valve 2 (control of gearshift fork valve 2 is stable) <= 5% • y factor change of safety valve 2 > 70% • control of safety valve 2 is stable >= 50 ms • duty factor change of gearshift > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0756	Shift Solenoid "B" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 – actual current of clutch 1) at switching point of control gearshift fork valve 2 with residual current at permanent control of control gearshift fork valve 2	• difference of residual current<= 200 mA (supply voltage at common high-side 1=7 V) .. 450 mA (supply voltage at common high-side 1=13 V)	• common high-side switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common high-side switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor change of safety valve 1 (control of safety valve 1 is stable) <= 5% • duty factor change of gearshift fork valve 1 (control of gearshift fork valve 1 is stable) <= 5% • duty factor of control gearshift fork valve 2 > 70% and steady state time >= 50ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0761	Shift Solenoid "C" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 – actual current of clutch 2) at switching point of control gearshift fork valve 3 with residual current at permanent control of control gearshift fork valve 3	• difference of residual current<= 200 mA (supply voltage at common high-side 2=7 V) .. 450 mA (supply voltage at common high-side 2=13 V)	• common high-side switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common high-side switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor change of safety valve 2 <= 5% (control of safety valve 2 is stable) • duty factor change of gearshift fork valve 4 <= 5% (control of gearshift fork valve 4 is stable) • duty factor of control gearshift fork valve 3 > 70% and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0766	Shift Solenoid "D" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 – actual current of clutch 2) at switching point of control gearshift fork valve 4 with residual current at permanent control of control gearshift fork valve 4	• difference of residual current<= 200 mA (supply voltage at common high-side 2=7 V) .. 450 mA (supply voltage at common high-side 2=13 V)	• common high-side switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common high-side switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor change of safety valve 2 <= 5% (control of safety valve 2 is stable) • duty factor change of gearshift fork valve 3 <= 5% (control of gearshift fork valve 3 is stable) • duty factor of control gearshift fork valve 4 > 70% and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0771	Shift Solenoid "E" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of central control (total current at common high-side switch 3 – actual current of main pressure valve and cooling oil valve) at switching point of multiplexer valve with residual current at permanent control of multiplexer valve	• difference of residual current <= 150 mA (maximum of supply voltage at common high-side 1,2 and terminal 15 =7 V) .. 300 mA (maximum of supply voltage at common high-side 1,2 and terminal 15 =13 V)	• common high-side switch 3 on and not defect • no short-circuit current check failure of main pressure solenoid valve • common high-side switch 1 and 2 voltage > 9.2 V • common high-side switches not deactivated by module 2 • change of supply voltage < 1 V • multiplexer valve is controled and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm		
P0776	Pressure Control Solenoid "B" Performance/ Stuck Off	• pressure integral monitoring	• integral of actual pressure minus desired pressure minus drain exceeds a maximum value	• pressure integral >= 0,1 bar*s	• desired pressure <= adapted clutch slipping point + 1 bar • standing vehicle with accelerator pedal < 0.1% • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• open-circuit check	• desired valve current of clutch 2 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold	• desired current> 350 mA actual current< 50 mA	• common high-side switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common high-side switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm		
P0777	Pressure Control Solenoid "B" Stuck On	• pressure buildup monitoring	• the number of successive pressure buildup failure of clutch 2 reaches a maximum value	• counter > 2	• engaged gear on input shaft 2 • desired pressure > adapted clutch slipping point – 0.2 bar • output speed < 200 rpm • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• short-circuit current check	• comparison of actual valve current with desired valve current of clutch 2	• actual current >desired current and (actual current-desired current) > 200 mA for more than 200 ms	• common high-side switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common high-side switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 200 ms	
P0781	1-2 Shift	• unable to disengage the first gear	• gearshift fork of first gear stays in shifted position in spite of control to disengage	• gearshift fork position > synchronizing point first gear + 10% synchronizing point measured by a basic adjustment (first gear stays in shifted position) control gearshift fork valve 2 >= 5%	• control safety valve 1 (ON) >= 20% • multiplexer position = 0 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0782	2-3 Shift	• unable to disengage the second gear	• gearshift fork of second gear stays in shifted position in spite of control to disengage	• gearshift fork position < synchronizing point second gear - 10% synchronizing point measured by a basic adjustment (second gear stays in shifted position) control gearshift fork valve 4 >= 5%	• control safety valve 1 (ON) >= 20% • multiplexer position = 1 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles
P0783	3-4 Shift	• unable to disengage the third gear	• gearshift fork of third gear stays in shifted position in spite of control to disengage	• gearshift fork position < synchronizing point third gear - 10% synchronizing point measured by a basic adjustment (third gear stays in shifted position) control gearshift fork valve 1 >= 5%	• control safety valve 1 (ON) >= 20% • multiplexer position = 0 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0784	4-5 Shift	• unable to disengage the fourth gear	• gearshift fork of fourth gear stays in shifted position in spite of control to disengage	• gearshift fork position > synchronizing point fourth gear + 10% synchronizing point measured by a basic adjustment (fourth gear stays in shifted position) control gearshift fork valve 3 >= 5%	• control safety valve 2 (ON) >= 20% • multiplexer position = 1 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles
P0791	Intermediate Shaft Speed Sensor "A" Circuit	• signal range check	• rotational speed of input shaft 1 exceed a maximum value OR • rotational speed of input shaft 2 exceed a maximum value	• rotational speed > 12000 rpm	• terminal 15 voltage > 4 V for more than 500 ms	• 100 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0797	Pressure Control Solenoid "C" Stuck On	• short-circuit current check	• comparison of actual valve current with desired valve current of main pressure solenoid valve	• actual current>desired current and (actual current-desired current) > 200 mA for more than 300 ms	• common high-side switch 3 on and not defect • common high-side switch 1 and 2 voltage > 9.2 V • common high-side switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles
P0829	5-6 Shift	• unable to disengage the fifth gear	• gearshift fork of fifth gear stays in shifted position in spite of control to disengage	• gearshift fork position > synchronizing point fifth gear + 10% synchronizing point measured by a basic adjustment (fifth gear stays in shifted position) control gearshift fork valve 2 >= 5%	• control safety valve 1(ON) >= 20% • multiplexer position = 1 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• unable to disengage the sixth gear	• gearshift fork of sixth gear stays in shifted position in spite of control to disengage	• gearshift fork position > synchronizing point sixth gear + 10% synchronizing point measured by a basic adjustment (sixth gear stays in shifted position) control gearshift fork valve 4 >= 5%	• control safety valve 2 (ON) >= 20% • multiplexer position = 0 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms		
P0840	Transmission Fluid Pressure Sensor/ Switch "A" Circuit	• signal range check	• pressure sensor voltage clutch 1 out of plausibility range	• voltage < 100 mV OR • voltage > 4900 mV		• 300 ms	• 2 driving cycles
P0841	Transmission Fluid Pressure Sensor/ Switch "A" Circuit Range/ Performance	• overpressure monitoring	• hydraulic pressure of clutch 1 exceeds a maximum value	• pressure>= 15.5 bar	• signal range check is correct • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 1000 ms	• 2 driving cycles
P0845	Transmission Fluid Pressure Sensor/ Switch "B" Circuit	• pressure sensor voltage clutch 2 out of plausibility range	• pressure sensor voltage clutch 1 out of plausibility range	• voltage < 100 mV OR • voltage > 4900 mV		• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0846	Transmission Fluid Pressure Sensor/ Switch "B" Circuit Range/ Performance	• overpressure monitoring	• hydraulic pressure of clutch 2 exceeds a maximum value	• pressure >= 15.5 bar	• signal range check is correct • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 80 ms	• 2 driving cycles
P0864	TCM Communication Circuit Range/ Performance	• buss off detection of the microcontroller			• terminal 15 voltage > 9 V for more than 500 ms • > 500 ms after reset	• 1000 ms	• 2 driving cycles
P0890	TCM Power Relay Sense Circuit Low	• short-circuit current check	• Detection by hardware circuit	• current > 8.5 A	• terminal 15 voltage > 4 V for more than 500 ms	• 200 ms	• 2 driving cycles
P0914	Gear Shift Position Circuit	• time out detection of the question and answer diagnosis	• if time out of the question and answer diagnosis is detected increment an event counter	• time out threshold > 100 ms	• gear message for selector lever is transmittable and selector lever message is receivable • no failure of selector lever CAN messages • time after Reset > 100 ms • terminal 15 voltage > 4 V for more than 500 ms	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• plausibility check of selector lever	• selector lever position is not equal to negation of the inverse selector lever position OR • selector lever position equals initialization value OR • selector lever position equals error value OR • selector lever position is equal to negation of the inverse selector lever position but no valid position	• selector lever position == Position 1 or Position 2 or Position 3 or Position 4 or Position L	• no bus off error • no error failure of all CAN messages • no failure of selector lever CAN messages • time after Reset > 1100 ms • terminal 15 voltage > 9 V for more than 1100 ms	• 1000 ms	
		• question and answer diagnosis	• failure of question and answer diagnosis			• 1500 ms	
P0919	Gear Shift Position Control Error	• evaluation the error signal of selector lever CAN message	• error flag of not determinable selector lever position is set		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 20 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• validity check of selector lever position	• if the selector lever position is equal to negation of the inverse selector lever position but is not valid (position == L, P4, P3, P2, or P1) AND • is not in error state (position ! = error) AND • initialization value with the initialization flag not set then increment an event counter		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms		
		• error detection of the question and answer diagnosis	• if the answer of the diagnosis is wrong an event counter is incremented		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms	• 100 ms	

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• plausibility check of selector lever position	• if the selector lever position is not equal to negation of the inverse selector lever position OR • selector lever position equals initialization value but the initialization flag is not set OR • selector lever position equals error value then increment an event counter		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 400 ms	
P0929	Gear Shift Lock Solenoid/ Actuator Control Circuit "A" Range/ Performance	• validity check of shiftlock position signal	• if the shiftlock position signal is not valid (position != error, deactive, active or init) increment an event counter		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms	• 20 ms	• 2 driving cycles
P2711	Unexpected Mechanical Gear Disengagement	• unable to engage a gear on shaft 1	• the number of successive engagements of the same gear on shaft 1 exceeds a maximum value	• counter>=6	• battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• unable to engage a gear on shaft 2	• the number of successive engagements of the same gear on shaft 2 exceeds a maximum value				
		• detect disengagement of gears on shaft 1 without control	• In spite of a constant desired gear disengagement counter exceeds a maximum value	• counter >3	• battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms • output speed >= 12 rpm		
		• detect disengagement of gears on shaft 2 without control	• In spite of a constant desired gear disengagement counter exceeds a maximum value				

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2723	Pressure Control Solenoid "E" Performance/ Stuck Off	• open-circuit check	• residual current of gearbox subsystem 1 (total current at common high-side switch 1 – actual current of clutch 1) is smaller than a minimum value	• residual current <= 150 mA (supply voltage at common high-side 1=7 V) .. 300 mA (supply voltage at common high-side 1=13 V)	• common high-side switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common high-side switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor of control gearshift fork valve 1 and 2 <= 10 % • duty factor of safety valve 1 >= 53% and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2732	Pressure Control Solenoid "F" Performance/ Stuck Off	• open-circuit check	• residual current of gearbox subsystem 2 (total current at common high-side switch 2 – actual current of clutch 2) is smaller than a minimum value	• residual current <= 150 mA (supply voltage at common high-side 2=7 V) .. 300 mA (supply voltage at common high-side 2=13 V)	• common high-side switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common high-side switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor of control gearshift fork valve 3 and <= 10 % • duty factor of safety valve 2 >= 53% and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles
U0100	Lost Communication With ECM/PCM "A"	• Timeout Check	• failure of all CAN engine messages	• time-out for more than 490 ms	• no bus off error • no error failure of all CAN messages • terminal 15 voltage > 9 V for more than 500 ms • >500 ms after reset	• 490 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• failure of one or more CAN engine messages (but not all CAN engine messages)	• time-out for more than 1010 ms	• no bus off error • no error failure of all CAN messages • no error failure of all CAN engine messages • terminal 15 voltage > 9 V for more than 500 ms • >500 ms after reset	• 1010 ms	
			• failure of all CAN messages but gearbox is still in position to send	• time-out for more than 2080 ms	• terminal 15 voltage > 9 V for more than 500 ms • >500 ms after reset	• 2080 ms	
U0103	Lost Communication With Gear Shift Control Module "A"	• Timeout Check	• failure of selector lever CAN messages	• time-out for more than 490 ms	• kein Bus off Fehler no bus off error • no error failure of all CAN messages • terminal 15 voltage > 9 V for more than 500 ms, >500 ms after reset	• 490 ms	• 2 driving cycles
U0404	Invalid Data Received From Gear Shift Control Module "A"	• evaluation of selector lever CAN message counter	• if the value of message counter is permanent constant or change exceeds a threshold increment an event counter	• maximum change of message counter > 5	• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms	• 50 ms	• 2 driving cycles

3.5.2 Transmission Control Module 09G (2016 MY)

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0604	Internal Control Module Random Access Memory (RAM) Error	• RAM area check	• Comparison of writing data and reading data	• Writing data is different from reading one		• 40 s	• 2 DCY
P0605	Internal Control Module Read Only Memory (ROM) Error	• ROM area check	• Comparison of stored checksum value and calculated checksum	• Two checksum values are not same		• 40 s	• 2 DCY
P0613	TCM Processor	• 2nd CPU detects miscalculation	• Check-calculation of first CPU failed	• Single reset does not cover problem		• xx s	• 2 DCY
P0614	ECM/TCM Incompatible	• CAN receive data check	• Detection of error signal	• Transmission coding is manual transmission code (0Fh) • Or • Max torque is not same as one in ATCU	• CAN bus active • ECU communication active • ECU data update active	• 250 ms	• 2 DCY
P0705	Transmission Range Sensor "A" Circuit (PRNDL Input)	• A, B, C and PA signal check in every shift lever position	• Detection of wrong combination of the A, B, C and PA signal	• Wrong combination for more than 350 ms		• 350 ms	• 2 DCY
P0715	Input Turbine/ Speed Sensor "A" Circuit	• Electrical check	• Detection of wrong input AD value	• Voltage < 0.2 volt (AD value < 45) for more than 100 ms • Or • (AD value > 545) voltage > 3.8 volt for more than 100 ms	• Input sensor: No failure decision for input sensor no pulse failure	• 100 ms • 5 times	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0716	Input/ Turbine Shaft Speed Sensor "A" Circuit Range/ Performance	• No pulse check	• Comparison pulse of input revolution and output revolution	• No pulse of input sensor more than 125 ms	• Engine speed > 400 rpm • Output sensor active • Output speed >= 300 rpm • Input sensor: no during failure detection or after failure decision for input sensor electrical failure	• 125 ms • 4 times	• 2 DCY
P0720	Output Shaft Speed Sensor Circuit	• Electrical check	• Detection of wrong input AD value	• Voltage < 0.2 volt (AD value < 45) for more than 100 ms • Or • (AD value > 545) voltage > 3.8 volt for more than 100 ms	• Output sensor: no failure decision for output sensor no pulse	• 100 ms • 5 times	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0721	Output Shaft Speed Sensor Circuit Range/ Performance	• No pulse check	• Comparison pulse of input revolution and output revolution	• No pulse of output sensor more than 250 ms	• Engine speed: > 400 rpm • Input sensor active • Calculated output speed by input speed: >= 300 rpm • Main solenoid switch on • Gear condition engage • Range: D, S • Inhibitor switch no fault • Output sensor: no during failure detection or after failure decision for output sensor electrical failure • Solenoid: no fault (except S2) • Linear solenoid: no fault	• 250 ms • 2 times	• 2 DCY
P0725	Engine Speed Input Circuit	• CAN receive data check	• Detection of error signal		• CAN bus active • ECU communication active • ECU data update active	• 250 ms	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0729	Gear 6 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. Slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• Engine speed > 400 rpm • Output revolutions > 250 rpm • Shift lever D or S • Brake off • Slip difference of output speed (In case ABS valid) difference < 10% • Revolution sensor no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 491)	• 1 s • 12 times • Cumulative	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0731	Gear 1 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• ABS (input rev – output rev x other gear ratio) < (0.04 x other gear ratio x output rev) for more than 1 s	• Engine speed > 400 rpm • Output revolutions > 250 rpm • Estimated engine torque > 100 Nm at 1st gear > 80 Nm at 1st EB gear • Shift lever D or S • Brake off • Slip difference of output speed and ABS difference < 10% (in case of ABS failure, this condition isn't activated) • Engaged gear 1st gear • Revolution sensor no back up condition • Model oil temperature >= 20° C • Common parameter, common condition (see footnote ⇒ page 491)	• 1 s • 12 times • Cumulative	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Neutral condition check	• Detection of slip condition	• Input revolutions > output revolutions x 1st gear ratio + 400 rpm for more than 3.3 s	• Engine speed > 400 rpm • Shift lever D or S • Output revolutions <= 500 rpm • Output revolutions which calculated from ABS <= 500 rpm (In case of ABS failure, this condition isn't activated) • L-up condition: OFF • Input sensor, no back up condition • Output sensor, active or back up by ABS • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 491)	• 2 times • Cumulative but, in case of changing the shift lever position, counter = 0	

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0732	Gear 2 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. Slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• Engine speed > 400 rpm • Output revolutions > 250 rpm • Shift lever D or S • Brake off • Slip difference of output speed (In case ABS valid) difference < 10% • Revolution sensor no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 491)	• 1 s • 12 times • Cumulative	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Neutral condition check	• Detection of slip condition	• Input revolutions > output revolutions x 1st gear ratio + 400 rpm for more than 3.3 s	• Engine speed > 400 rpm • Shift lever D or S • Output revolutions <= 500 rpm • Output revolutions which calculated from ABS <= 500 rpm (In case of ABS failure, this condition isn't activated) • L-up condition off • Input sensor no back up condition • Output sensor active or back up by ABS • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 491)	• 2 times • Cumulative but, in case of changing the shift lever position, counter = 0	

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0733	Gear 3 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. Slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• Engine speed > 400 rpm • Output revolutions > 250 rpm • Shift lever D or S • Brake off • Slip difference of output speed (In case ABS valid) difference < 10% • Revolution sensor no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 491)	• 1 s • 12 times • Cumulative	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0734	Gear 4 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. Slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• Engine speed > 400 rpm • Output revolutions > 250 rpm • Shift lever D or S • Brake off • Slip difference of output speed (In case ABS valid) difference < 10% • Revolution sensor no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 491)	• 1 s • 12 times • Cumulative	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0735	Gear 5 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. Slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• Engine speed > 400 rpm • Output revolutions > 250 rpm • Shift lever D or S • Brake off • Slip difference of output speed (In case ABS valid) difference < 10% • Revolution sensor no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 491)	• 1 s • 12 times • Cumulative	• 2 DCY
P0743	Torque Converter Clutch Circuit Electrical	• Input AD value check in every linear solenoid	• Detection of wrong input AD value	• Feedback current > 1,333 mA (AD value > 1,000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• Feedback current < 23 mA (AD value < 15) for more than 100 ms	• Main solenoid switch on		
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000	• Linear feedback current > 23 mA (AD:15) < 1,333 mA (AD: 1,000)	• 2 times • Continuously	

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0748	Pressure Control Solenoid "A" Electrical	• Input AD value check in every linear solenoid	• Detection of wrong input AD value	• Feedback current > 1,333 mA (AD value > 1,000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• Feedback current < 23 mA (AD value < 15) for more than 100 ms	• Main solenoid switch on		
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000	• Linear feedback current is > 23 mA (AD:15) < 1,333 mA (AD: 1,000)	• 2 times • Continuously	
P0753	Shift Solenoid "A" Electrical	• Conduction check in ON/OFF solenoid	• Comparison of the signal of solenoid monitor and solenoid driver output	• Wrong output signal for more than 100 ms		• 100 ms • 5 times	• 2 DCY
P0798	Pressure Control Solenoid "C" Electrical	• Input AD value check in every linear solenoid	• Detection of wrong input AD value	• Feedback current > 1,333 mA (AD value > 1,000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• Feedback current < 23 mA (AD value < 15) for more than 100 ms	• Main solenoid switch on		
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000	• Linear feedback current is > 23 mA (AD:15) < 1,333 mA (AD: 1,000)	• 2 times • Continuously	

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0811	Excessive Clutch "A" Slippage	• Off stuck check	• Comparison of engine rpm and input rpm	• Engine rpm – input rpm > 100 rpm for 2 s	• Engine speed > 400 rpm • Shift lever D or S • Engine speed < 4,000 rpm • Estimated engine torque >= 0 Nm • Revolution sensor, no back up condition • SLU target current > 1,000 mA • Model oil temperature >= 20° C • Common parameter, common condition (see footnote ⇒ page 491)	• 2 s • 6 times • Continuously	• 2 DCY
P0864	TCM Communication Circuit Range/ Performance	• CAN communication check	• Detection of communication error (all frames which are entered in ATCU)	• ECU no communication for more than 50 ms (In case of repeat rate is over 25 ms, double value of repeat rate is used)	• CAN bus active • Time: 500 ms after ignition on	• 500 ms (In case of re peat rate is over 50 ms, 10 times value of repeat rate is used)	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• Detection of communication error (one frame which is entered in ATCU)		• CAN bus active • Time: 500 ms after ignition on • ECU communication: not in no communication failure	• 1,000 ms (In case of repeat rate is over 50 ms, 20 times value of repeat rate is used)	
		• CAN receive data check	• ECU signal data freeze (data counter (ID488, Byte8, Bit7…4) not updated)		• CAN bus active • CAN data repeat rate: the space of time between two received messages has not exceeded double the transmission cycle time	• No update in five message	
		• CAN communication check	• Detection of communication error	• No acknowledge condition for more than 300 ms	• CAN bus active • Time: 500 ms after ignition on	• 300 ms	
P0865	TCM Communication Circuit Low	• CAN communication check	• Detection of communication error	• CAN BUS off condition for more than 250 ms	• Time 500 ms after ignition on	• 250 ms	• 2 DCY
P2122	Throttle/ Pedal Position Sensor/ Switch "D" Circuit Low	• CAN receive data check	• Detection of error signal		• CAN bus active • ECU communication active • ECU data update active	• 250 ms	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2637	Torque Management Feedback Signal "A"	• CAN receive data check for “signal invalid”	• Detection of error signal (0xFF)		• CAN bus active • ECU communication active • ECU data update active	• 250 ms	• 2 DCY
P2716	Pressure Control Solenoid "D" Electrical	• Input AD value check in every linear solenoid	• Detection of wrong input AD value	• Feedback current > 1,333 mA (AD value > 1,000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• Feedback current < 23 mA (AD value < 15) for more than 100 ms	• Main solenoid switch on		
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000	• Linear feedback current is > 23 mA (AD:15) < 1,333 mA (AD: 1,000)	• 2 times • Continuously	
P2725	Pressure Control Solenoid "E" Electrical	• Input AD value check in every linear solenoid	• Detection of wrong input AD value	• Feedback current > 1,333 mA (AD value > 1,000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• Feedback current < 23 mA (AD value < 15) for more than 100 ms	• Main solenoid switch on		
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000	• Linear feedback current is > 23 mA (AD:15) < 1,333 mA (AD: 1,000)	• 2 times • Continuously	

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2734	Pressure Control Solenoid "F" Electrical	• Input AD value check in every linear solenoid	• Detection of wrong input AD value	• Feedback current > 1,333 mA (AD value > 1,000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• Feedback current < 23 mA (AD value < 15) for more than 100 ms	• Main solenoid switch on		
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000	• Linear feedback current is > 23 mA (AD:15) < 1,333 mA (AD: 1,000)	• 2 times • Continuously	

Footnote:

Common parameter for enabling gear ratio or lock up errors:

- main solenoid switch ON
- gear condition engaged
- S1 solenoid No fault
- linear solenoid no fault
- inhibitor switch no fault
- CAN communication no fault
- ECU data update no fault
- estimated engine torque no fault
- engine speed no fault
- accelerator pedal no fault
- T/M coding and MDI max info no fault
- ROM no fault
- RAM no fault
- safety processor no fault

3.5.3 Transmission Control Module 6 speed, 02E (2016 MY)

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0219	Engine Overspeed Condition	• signal range check	• rotational speed of gearbox input shaft exceed a maximum value	• rotational speed> 12000 rpm	• terminal 15 voltage > 4 V for more than 500 ms	• 500 ms	• 2 driving cycles
P0501	Vehicle Speed Sensor "A" Circuit Range/ Performance	• plausibility check	• calculate the speed of input shaft with the gear ratio of engaged gear on input shaft and the output shaft speed. compare the calculated speed with measured speed of input shaft	• speed difference magnitude > 330 rpm (output speed = 500 rpm) – 100 rpm (output speed>=2000 rpm)	• gear on input shaft engaged • no valid CAN output speed information • output speed > 25 rpm OR speed of input shaft > 1000 rpm • terminal 15 voltage >4 V for more than 500 ms • battery voltage >9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 300 ms	• 2 driving cycles
P0701	Transmission Control System Range/ Performance	• signal range check	• travel sensor voltage gearshift fork 1/3 out of plausibility range	• voltage < 100 mV OR • voltage > 4900 mV		• 300 ms	• 2 driving cycles
			• travel sensor voltage gearshift fork 2/4 out of plausibility range				
			• travel sensor voltage gearshift fork 5/N out of plausibility range				

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• travel sensor voltage gearshift fork 6/R out of plausibility range				
P0702	Transmission Control System Electrical	• plausibility check	• In spite of cut off Common Highside Switch 1 a measurable current. In spite of turned on Common Highside Switch 1 no current measurable.	• CHS1 cut off and CHS1-Current> 40 mA CHS1 turned on and CHS1-Current< 200 mA	• one-time after reset • terminal 15 voltage < 18 V • no short-circuit current check failure of CHS1 • common highside switch 1 voltage >9.2V • gearbox subsystem 1 active • common highside switches not deactivated by module 2	• 300 ms	• 2 driving cycles
			• In spite of cut off Common Highside Switch 2 a measurable current. In spite of turned on Common Highside Switch 2 no current measurable.	• CHS2 cut off and CHS2-Current> 40 mA CHS2 turned on and CHS2-Current< 200 mA	• one-time after reset • terminal 15 voltage < 18 V • no short-circuit current check failure of CHS2 • common highside switch 2 voltage >9.2V • gearbox subsystem 2 active • common highside switches not deactivated by module 2		

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• In spite of cut off Common Highside Switch 3 a measurable current. In spite of turned on Common Highside Switch 3 no current measurable.	• CHS3 cut off and CHS3-Current> 40 mA CHS3 turned on and CHS3-Current< 200 mA	• one-time after reset • terminal 15 voltage < 18 V • no short-circuit current check failure of CHS3 and main pressure solenoid valve • common highside switch 1 and 2 voltage >9.2V • common highside switches not deactivated by module 2		
P0717	Input/ Turbine Shaft Speed Sensor "A" Circuit No Signal	• plausibility check	• calculate the speed of input shaft 1 with the gear ratio of engaged gear on input shaft 1 and the output shaft speed. compare the calculated speed with measured speed of input shaft 1	• speed difference magnitude> 330 rpm (output speed = 500rpm)… 100 rpm (output speed>=2000 rpm)	• gear engaged on input shaft 1 • valid CAN output speed information • speed of input shaft 1 < 25 rpm • output speed > 25 rpm • terminal 15 voltage >4 V for more than 500 ms • battery voltage >9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 900 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• calculate the speed of input shaft 2 with the gear ratio of engaged gear on input shaft 2 and the output shaft speed. compare the calculated speed with measured speed of input shaft 2		• gear engaged on input shaft 2 • valid CAN output speed information • speed of input shaft 2 < 25 rpm • output speed > 25 rpm • terminal 15 voltage >4 V for more than 500 ms • battery voltage >9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms		
P0729	Gear 6 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage sixth gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• integral > 125	• no slipping point adaptation of clutch 2 • multiplexer position = 0 • control gearshift fork valve 3 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 2	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0731	Gear 1 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage 1st gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1	• integral > 125	• no slipping point adaptation of clutch 1 • multiplexer position = 0 • control gearshift fork valve 1 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 1	• 2 driving cycles
P0732	Gear 2 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage second gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• integral > 125	• no slipping point adaptation of clutch 2 • multiplexer position = 1 • control gearshift fork valve 3>= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 2	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0733	Gear 3 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage third gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1	• integral > 125	• no slipping point adaptation of clutch 1 • multiplexer position = 0 • control gearshift fork valve 2 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 1	• 2 driving cycles
P0734	Gear 4 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage fourth gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• integral > 125	• no slipping point adaptation of clutch 2 • multiplexer position = 1 • control gearshift fork valve 4 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 2	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0735	Gear 5 Incorrect Ratio	• synchronizing detection while the gearshift fork was controlled to engage fifth gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1	• integral > 125	• no slipping point adaptation of clutch 1 • multiplexer position = 1 • control gearshift fork valve 1>= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• synchronizing slip, duty factor of safety valve 1	• 2 driving cycles
P0736	Reverse Incorrect Ratio	• unable to disengage the reverse gear	• gearshift fork of reverse gear stays in shifted position in spite of control to disengage	• gearshift fork position < synchronizing point reverse gear - 10% synchronizing point measured by a basic adjustment (reverse gear stays in shifted position) control gearshift fork	• control safety valve 2 (ON) >= 20% • multiplexer position = 0 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• synchronizing detection while the gearshift fork was controlled to engage reverse gear	• integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• integral > 125	• no slipping point adaptation of clutch 1 • multiplexer position = 0 • control gearshift fork valve 4 >= 5% • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms		
P0746	Pressure Control Solenoid "A" Performance/ Stuck Off	• pressure integral monitoring	• integral of actual pressure minus desired pressure minus drain exceeds a maximum value	• pressure integral>= 0,1 bar * s	• desired pressure <= adapted clutch slipping point + 1 bar • standing vehicle with accelerator pedal < 0.1% • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• open-circuit check	• desired valve current of clutch 1 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold	• desired current> 350 mA actual current< 50 mA	• common highside switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common highside switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm		
P0747	Pressure Control Solenoid "A" Stuck On	• pressure buildup monitoring	• the number of successive pressure buildup failure of clutch 1 reaches a maximum value	• counter > 2	• engaged gear on input shaft 1 • desired pressure >adapted clutch slipping point – 0.2 bar • output speed < 200 rpm • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• short-circuit current check	• comparison of actual valve current with desired valve current of clutch 1	• actual current>desired current and (actual current-desired current)> 200 mA for more than 200 ms	• common highside switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common highside switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 200 ms	

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0751	Shift Solenoid "A" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of gearbox subsystem 1 (total current at common highside switch 1 – actual current of clutch 1) at switching point of control gearshift fork valve 1 with residual current at permanent control of control gearshift fork valve 1	• difference of residual current<= 200 mA (supply voltage at common highside 1=7 V) 450 mA (supply voltage at common highside 1=13 V)	• common highside switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common highside switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor change of safety valve 1 (control of safety valve 1 is stable) <= 5% • duty factor change of gearshift fork valve 2 (control of gearshift fork valve 2 is stable) <= 5% • y factor change of safety valve 2 > 70% • control of safety valve 2 is stable >= 50 ms • duty factor change of gearshift > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0756	Shift Solenoid "B" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of gearbox subsystem 1 (total current at common highside switch 1 – actual current of clutch 1) at switching point of control gearshift fork valve 2 with residual current at permanent control of control gearshift fork valve 2	• difference of residual current<= 200 mA (supply voltage at common highside 1=7 V) , 450 mA (supply voltage at common highside 1=13 V)	• common highside switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common highside switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor change of safety valve 1 (control of safety valve 1 is stable) <= 5% • duty factor change of gearshift fork valve 1 (control of gearshift fork valve 1 is stable) <= 5% • duty factor of control gearshift fork valve 2 > 70% and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0761	Shift Solenoid "C" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of gearbox subsystem 2 (total current at common highside switch 2 – actual current of clutch 2) at switching point of control gearshift fork valve 3 with residual current at permanent control of control gearshift fork valve 3	• difference of residual current<= 200 mA (supply voltage at common highside 2=7 V) 450 mA (supply voltage at common highside 2=13 V)	• common highside switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common highside switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor change of safety valve 2 <= 5% (control of safety valve 2 is stable) • duty factor change of gearshift fork valve 4 <= 5% (control of gearshift fork valve 4 is stable) • duty factor of control gearshift fork valve 3 > 70% and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0766	Shift Solenoid "D" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of gearbox subsystem 2 (total current at common highside switch 2 – actual current of clutch 2) at switching point of control gearshift fork valve 4 with residual current at permanent control of control gearshift fork valve 4	• difference of residual current<= 200 mA (supply voltage at common highside 2=7 V) 450 mA (supply voltage at common highside 2=13 V)	• common highside switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common highside switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor change of safety valve 2 <= 5% (control of safety valve 2 is stable) • duty factor change of gearshift fork valve 3 <= 5% (control of gearshift fork valve 3 is stable) • duty factor of control gearshift fork valve 4 > 70% and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0771	Shift Solenoid "E" Performance/ Stuck Off	• open-circuit check	• Comparison of residual current of central control (total current at common highside switch 3 – actual current of main pressure valve and cooling oil valve) at switching point of multiplexer valve with residual current at permanent control of multiplexer valve	• difference of residual current <= 150 mA (maximum of supply voltage at common highside 1,2 and terminal 15 =7 V) 300 mA (maximum of supply voltage at common highside 1,2 and terminal 15 =13 V)	• common highside switch 3 on and not defect • no short-circuit current check failure of main pressure solenoid valve • common highside switch 1 and 2 voltage > 9.2 V • common highside switches not deactivated by module 2 • change of supply voltage < 1 V • multiplexer valve is controlled and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm		
P0776	Pressure Control Solenoid "B" Performance/ Stuck Off	• pressure integral monitoring	• integral of actual pressure minus desired pressure minus drain exceeds a maximum value	• pressure integral >= 0,1 bar * s	• desired pressure <= adapted clutch slipping point + 1 bar • standing vehicle with accelerator pedal < 0.1% • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• open-circuit check	• desired valve current of clutch 2 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold	• desired current> 350 mA actual current< 50 mA	• common highside switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common highside switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm		
P0777	Pressure Control Solenoid "B" Stuck On	• pressure buildup monitoring	• the number of successive pressure buildup failure of clutch 2 reaches a maximum value	• counter > 2	• engaged gear on input shaft 2 • desired pressure > adapted clutch slipping point – 0.2 bar • output speed < 200 rpm • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• short-circuit current check	• comparison of actual valve current with desired valve current of clutch 2	• actual current >desired current and (actual current-desired current) > 200 mA for more than 200 ms	• common highside switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common highside switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 200 ms	
P0781	1-2 Shift	• unable to disengage the 1st gear	• gearshift fork of 1st gear stays in shifted position in spite of control to disengage	• gearshift fork position > synchronizing point 1st gear + 10% synchronizing point measured by a basic adjustment (1st gear stays in shifted position) control gearshift fork valve 2 >= 5%	• control safety valve 1 (ON) >= 20% • multiplexer position = 0 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0782	2-3 Shift	• unable to disengage the second gear	• gearshift fork of second gear stays in shifted position in spite of control to disengage	• gearshift fork position < synchronizing point second gear - 10% synchronizing point measured by a basic adjustment (second gear stays in shifted position) control gearshift fork valve 4 >= 5%	• control safety valve 1 (ON) >= 20% • multiplexer position = 1 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles
P0783	3-4 Shift	• unable to disengage the third gear	• gearshift fork of third gear stays in shifted position in spite of control to disengage	• gearshift fork position < synchronizing point third gear - 10% synchronizing point measured by a basic adjustment (third gear stays in shifted position) control gearshift fork valve 1 >= 5%	• control safety valve 1 (ON) >= 20% • multiplexer position = 0 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0784	4-5 Shift	• unable to disengage the fourth gear	• gearshift fork of fourth gear stays in shifted position in spite of control to disengage	• gearshift fork position > synchronizing point fourth gear + 10% synchronizing point measured by a basic adjustment (fourth gear stays in shifted position) control gearshift fork valve 3 >= 5%	• control safety valve 2 (ON) >= 20% • multiplexer position = 1 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles
P0791	Intermediate Shaft Speed Sensor "A" Circuit	• signal range check	• rotational speed of input shaft 1 exceed a maximum value	• rotational speed > 12000 rpm	• terminal 15 voltage > 4 V for more than 500 ms	• 100 ms	• 2 driving cycles
			• rotational speed of input shaft 2 exceed a maximum value				

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0797	Pressure Control Solenoid "C" Stuck On	• short-circuit current check	• comparison of actual valve current with desired valve current of main pressure solenoid valve	• actual current>desired current and (actual current-desired current) > 200 mA for more than 300 ms	• common highside switch 3 on and not defect • common highside switch 1 and 2 voltage > 9.2 V • common highside switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles
P0829	5-6 Shift	• unable to disengage the fifth gear	• gearshift fork of fifth gear stays in shifted position in spite of control to disengage	• gearshift fork position > synchronizing point fifth gear + 10% synchronizing point measured by a basic adjustment (fifth gear stays in shifted position) control gearshift fork valve 2 >= 5%	• control safety valve 1(ON) >= 20% • multiplexer position = 1 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 6000 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• unable to disengage the sixth gear	• gearshift fork of sixth gear stays in shifted position in spite of control to disengage	• gearshift fork position > synchronizing point sixth gear + 10% synchronizing point measured by a basic adjustment (sixth gear stays in shifted position) control gearshift fork valve 4 >= 5%	• control safety valve 2 (ON) >= 20% • multiplexer position = 0 • desired main pressure > 2 bar • no main pressure loss • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms		
P0840	Transmission Fluid Pressure Sensor/ Switch "A" Circuit	• signal range check	• pressure sensor voltage clutch 1 out of plausibility range	• voltage < 100 mV OR • voltage > 4900 mV		• 300 ms	• 2 driving cycles
P0841	Transmission Fluid Pressure Sensor/ Switch "A" Circuit Range/ Performance	• overpressure monitoring	• hydraulic pressure of clutch 1 exceeds a maximum value	• pressure>= 15.5 bar	• signal range check is correct • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 1000 ms	• 2 driving cycles
P0845	Transmission Fluid Pressure Sensor/ Switch "B" Circuit	• pressure sensor voltage clutch 2 out of plausibility range	• pressure sensor voltage clutch 1 out of plausibility range	• voltage < 100 mV OR • voltage > 4900 mV		• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0846	Transmission Fluid Pressure Sensor/ Switch "B" Circuit Range/ Performance	• overpressure monitoring	• hydraulic pressure of clutch 2 exceeds a maximum value	• pressure >= 15.5 bar	• signal range check is correct • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 80 ms	• 2 driving cycles
P0864	TCM Communication Circuit Range/ Performance	• buss off detection of the microcontroller			• terminal 15 voltage > 9 V for more than 500 ms • > 500 ms after reset	• 1000 ms	• 2 driving cycles
P0890	TCM Power Relay Sense Circuit Low	• short-circuit current check	• Detection by hardware circuit	• current > 8.5 A	• terminal 15 voltage > 4 V for more than 500 ms	• 200 ms	• 2 driving cycles
P0914	Gear Shift Position Circuit	• time out detection of the question and answer diagnosis	• if time out of the question and answer diagnosis is detected increment an event counter	• time out threshold > 100 ms	• gear message for selector lever is transmittable and selector lever message is receivable • no failure of selector lever CAN messages • time after Reset > 100 ms • terminal 15 voltage > 4 V for more than 500 ms	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• plausibility check of selector lever	• selector lever position is not equal to negation of the inverse selector lever position OR • selector lever position equals initialization value OR • selector lever position equals error value OR • selector lever position is equal to negation of the inverse selector lever position but no valid position	• selector lever position = Position 1 or Position 2 or Position 3 or Position 4 or Position L	• no bus off error • no error failure of all CAN messages • no failure of selector lever CAN messages • time after Reset > 1100 ms • terminal 15 voltage > 9 V for more than 1100 ms	• 1000 ms	
		• question and answer diagnosis	• failure of question and answer diagnosis			• 1500 ms	
P0919	Gear Shift Position Control Error	• evaluation the error signal of selector lever CAN message	• error flag of not determinable selector lever position is set		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 20 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• validity check of selector lever position	• if the selector lever position is equal to negation of the inverse selector lever position but is not valid (position = L, P4, P3, P2, or P1) AND • is not in error state (position != error) AND • initialization value with the initialization flag not set then increment an event counter		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms		
		• error detection of the question and answer diagnosis	• if the answer of the diagnosis is wrong an event counter is incremented		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms	• 100 ms	

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• plausibility check of selector lever position	• if the selector lever position is not equal to negation of the inverse selector lever position OR • selector lever position equals initialization value but the initialization flag is not set OR • selector lever position equals error value then increment an event counter		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms • battery voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 400 ms	
P0929	Gear Shift Lock Solenoid/ Actuator Control Circuit "A" Range/ Performance	• validity check of shiftlock position signal	• if the shiftlock position signal is not valid (position ! = error, deactive, active or init) increment an event counter		• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms	• 20 ms	• 2 driving cycles
P2711	Unexpected Mechanical Gear Disengagement	• unable to engage a gear on shaft 1	• the number of successive engagements of the same gear on shaft 1 exceeds a maximum value	• counter>=6	• battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms	• 0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• unable to engage a gear on shaft 2	• the number of successive engagements of the same gear on shaft 2 exceeds a maximum value				
		• detect disengagement of gears on shaft 1 without control	• In spite of a constant desired gear disengagement counter exceeds a maximum value	• counter >3	• battery voltage > 9 V for more than 500 ms • engine speed > 600 rpm for more than 500 ms • output speed >= 12 rpm		
		• detect disengagement of gears on shaft 2 without control	• In spite of a constant desired gear disengagement counter exceeds a maximum value				

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2723	Pressure Control Solenoid "E" Performance/ Stuck Off	• open-circuit check	• residual current of gearbox subsystem 1 (total current at common highside switch 1 – actual current of clutch 1) is smaller than a minimum value	• residual current <= 150 mA (supply voltage at common highside 1=7 V) 300 mA (supply voltage at common highside 1=13 V)	• common highside switch 1 on, not defect and voltage > 9.2 V • gearbox subsystem 1 active • common highside switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor of control gearshift fork valve 1 and 2 <= 10% • duty factor of safety valve 1 >= 53% and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2732	Pressure Control Solenoid "F" Performance/ Stuck Off	• open-circuit check	• residual current of gearbox subsystem 2 (total current at common highside switch 2 – actual current of clutch 2) is smaller than a minimum value	• residual current <= 150 mA (supply voltage at common highside 2=7 V) 300 mA (supply voltage at common highside 2=13 V)	• common highside switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common highside switches not deactivated by module 2 • change of supply voltage < 1 V • duty factor of control gearshift fork valve 3 and <= 10% • duty factor of safety valve 2 >= 53% and steady state time >= 50 ms • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm	• 300 ms	• 2 driving cycles
U0100	Lost Communication With ECM/PCM "A"	• Timeout Check	• failure of all CAN engine messages	• time-out for more than 490 ms	• no bus off error • no error failure of all CAN messages • terminal 15 voltage > 9 V for more than 500 ms • >500 ms after reset	• 490 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• failure of one or more CAN engine messages (but not all CAN engine messages)	• time-out for more than 1010 ms	• no bus off error • no error failure of all CAN messages • no error failure of all CAN engine messages • terminal 15 voltage > 9 V for more than 500 ms • >500 ms after reset	• 1010 ms	
			• failure of all CAN messages but gearbox is still in position to send	• time-out for more than 2080 ms	• terminal 15 voltage > 9 V for more than 500 ms • >500 ms after reset	• 2080 ms	
U0103	Lost Communication With Gear Shift Control Module "A"	• Timeout Check	• failure of selector lever CAN messages	• time-out for more than 490 ms	• kein Bus off Fehler no bus off error • no error failure of all CAN messages • terminal 15 voltage > 9 V for more than 500 ms, >500 ms after reset	• 490 ms	• 2 driving cycles
U0404	Invalid Data Received From Gear Shift Control Module "A"	• evaluation of selector lever CAN message counter	• if the value of message counter is permanent constant or change exceeds a threshold increment an event counter	• maximum change of message counter > 5	• no failure of selector lever CAN messages • terminal 15 voltage > 4 V for more than 500 ms	• 50 ms	• 2 driving cycles

3.6 Diagnostic Procedures

- ⇒ S3.6.28 econdary Air System GX24, Checking (Passat)”, page 580
- ⇒ S3.6.29 econdary Air SystemGX24, Checking (All others)”, page 581
- ⇒ W3.6.30 ay Catalytic Converter (TWC), Checking”, page 584
- ⇒ T3.6.31 hrottle Valve Control Module GX3, Checking”, page 585
- ⇒ T3.6.32 urbocharger Recirculation ValveN249, Checking”, page 588
- ⇒ S3.6.33 peed Signal, Checking”, page 589

3.6.1 Accelerator Pedal Module - GX2-, Checking

General Description

The Accelerator Pedal Position Sensor -G79- and Accelerator Pedal Position Sensor 2 -G185- are combined in one component and integrated into the Accelerator Pedal Module - GX2-. They are used to detect the position of the accelerator pedal throughout the entire adjustment range. The Engine Control Module - J623- detects the driver’s request from these signals and uses them to calculate the injection quantity and EPC Throttle valve operation.

The Accelerator Pedal Module - GX2- contains the following components:

- Accelerator Pedal Position Sensor -G79-
- Accelerator Pedal Position Sensor 2 -G185-

The Accelerator Pedal Module - GX2- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck", page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 523 . – NO: ♦ GATHER more information from customer about the complaint.
2	• CONNECT: Scan Tool. • IGNITION: ON. • CHECK: Throttle valve position closed: • SPECIFIED VALUE: 3 – 25%. • DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly. • CHECK: Throttle valve position at WOT: • SPECIFIED VALUE: 84 – 99%. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ Condition may be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 524 . – NO: ♦ GO TO: Step 3 ⇒ page 523 .
3	• DISCONNECT: Accelerator Pedal Module - GX2- harness connector. • IGNITION: ON. • CHECK: Accelerator Pedal Module - GX2- harness connector terminals 1 to 5 and 2 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Were Values obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 523 . – NO: ♦ GO TO: Step 5 ⇒ page 524 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 4 to the Engine Control Module - J623- harness connector T91 / 52 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 6 to the Engine Control Module - J623- harness connector T91 / 69 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Accelerator Pedal Module - GX2-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 524 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 524 .

Step	Procedure	Result / Action to Take
5	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 1 to the Engine Control Module - J623- harness connector T91 / 16 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 2 to the Engine Control Module - J623- harness connector T91 / 33 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 3 to the Engine Control Module - J623- harness connector T91 / 34 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 5 to the Engine Control Module - J623- harness connector T91 / 51 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 6 ⇒ page 524 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 524 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.2 Camshaft Adjustment Valve 1 -N205-, Checking

General Description

The camshaft's task is to operate the valves at the right time and in the right order to control the charge cycle. Camshaft adjustment using the Camshaft Adjustment Valve 1 -N205- varies the opening times of the valves to suit all operating conditions. This ensures ideal charge cycles within a wide range of engine speeds and loads. Fuel consumption and pollutant emissions are reduced, torque and smoothness increased. In engines with a double overhead camshaft the size and positioning of the valve opening overlap can be influenced, enhancing characteristics in full-load and part-load operation. In continuous

camshaft adjustment, the adjustment is infinitely variable within specific parameters.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 525 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Camshaft Adjustment Valve 1 -N205- harness connector. • CHECK: Camshaft Adjustment Valve 1 -N205- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 5 – 20 Ω (+/- 3 Ω @ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 525 . – NO: ♦ REPLACE: Camshaft Adjustment Valve 1 -N205-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 526 .
3	• IGNITION: ON. • CHECK: Camshaft Adjustment Valve 1 -N205- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 526 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 526 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Camshaft Adjustment Valve 1 -N205- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 105 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ TIP: The Camshaft Adjustment Valve 1 -N205- may fail under loaded operation; please swap a known good Camshaft Adjustment Valve 1 -N205- prior to continuing to the next step. ♦ GO TO: Step 5 ⇒ page 526 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 526 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC’s. ♦ If no DTC’s return the repair is complete. ♦ Return vehicle to customer.

3.6.3 Camshaft Position Sensor -G40-, Checking

General Description

Using the signal from the Camshaft Position Sensor -G40-, the precise position of the camshaft relative to the crankshaft is determined very quickly when the engine is started. Used in combination with the signal from the Engine Speed Sensor -G28-, the signal from the Camshaft Position Sensor -G40- allows the Engine Control Module -J623- to detect which cylinder is at TDC. The fuel can be injected into the corresponding cylinder and ignited.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 527 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Camshaft Position Sensor -G40- harness connector. • IGNITION: ON. • CHECK: Camshaft Position Sensor -G40- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 527 . – NO: ◆ GO TO: Step 4 ⇒ page 528 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor -G40- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 30 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Camshaft Position Sensor -G40-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 528 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 528 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor -G40- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 48 for resistance. • CHECK: Camshaft Position Sensor -G40- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 47 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 528 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 528 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC’s. ♦ If no DTC’s return the repair is complete. ♦ Return vehicle to customer.

3.6.4 CAN-Bus Terminal Resistance, Checking

General Description

The Engine Control Module -J623- communicates with other CAN-Bus capable control modules.

The control modules are connected by two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the CAN-bus is recognized as a malfunction by the Engine Control Module -J623- and the other control modules connected to the CAN-bus.

Trouble-free operation of the CAN-Bus requires that it have a terminal resistance. This central terminal resistance is located in the Engine Control Module -J623-.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 529 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: FOR JETTA (2.0L) only, the Data Bus On Board Diagnostic Interface -J533- harness connector. • DISCONNECT: FOR ALL BEETLES, JETTA (1.8L), the Vehicle Electrical System Control Module -J519- harness connector. • DISCONNECT: FOR PASSAT only, the Instrument Cluster Control Module -J285- harness connector. • The Engine Control Module -J623- must remain connected for the following step. • FOR JETTA (2.0L) only, CHECK: Data Bus On Board Diagnostic Interface -J533- harness connector terminals 16 to 6 for resistance. • FOR ALL BEETLES, JETTA (1.8L), CHECK: Vehicle Electrical System Control Module -J519- harness connector terminals 18 to 19 for resistance. • FOR PASSAT only, CHECK: Instrument Cluster Control Module -J285- harness connector terminals 28 to 29 for resistance. • Specified value: 60 to 72 Ω (at approx. 20° C). – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 531 . – NO: ♦ GO TO: Step 3 ⇒ page 530 .

Step	Procedure	Result / Action to Take
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • FOR JETTA (2.0L) only, CHECK: Data Bus On Board Diagnostic Interface -J533- harness connector terminal 6 to the Engine Control Module - J623- harness connector T91 / 80 for resistance. • FOR ALL BEETLES, JETTA (1.8L), CHECK: Vehicle Electrical System Control Module - J519- harness connector terminal 18 to the Engine Control Module - J623- harness connector T91 / 80 for resistance. • FOR PASSAT only, CHECK Instrument Cluster Control Module -J285- harness connector terminal 29 to the Engine Control Module - J623- harness connector T91 / 80 for resistance. • FOR JETTA (2.0L) only, CHECK: Data Bus On Board Diagnostic Interface -J533- harness connector terminal 16 to the Engine Control Module - J623- harness connector T91 / 79 for resistance. • FOR ALL BEETLES, JETTA (1.8L), CHECK: Vehicle Electrical System Control Module - J519- harness connector terminal 19 to the Engine Control Module - J623- harness connector T91 / 79 for resistance. • FOR PASSAT only, CHECK Instrument Cluster Control Module -J285- harness connector terminal 28 to the Engine Control Module - J623- harness connector T91 / 79 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 531 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 531 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Data Bus On Board Diagnostic Interface -J533- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC’s. Refer to ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Data Bus On Board Diagnostic Interface -J533-. Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC’s. ◆ If no DTC’s return the repair is complete. ◆ Return vehicle to customer.

3.6.5 CAN-Bus Terminal Resistance, Transmission Control Module - J217- to Engine Control Module - J623-, Checking

General Description

The Engine Control Module -J623- communicates with all databus capable control modules via a CAN databus.

These databus capable control modules are connected via two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the databus is recognized as a malfunction and stored.

Trouble-free operation of the CAN-bus requires that it have a terminal resistance. The central terminal resistor is located in the Engine Control Module -J623-.

Special tools and workshop equipment required

◆ Multimeter.

◆ Wiring Diagram.

Test requirements

• Fuses OK.

• Battery voltage OK.

• Switch OFF all electrical and electronic accessories.

• Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.

• Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.

- Observe all Safety Precautions: ⇒ P1.1 recautions", page 2 .
- View Clean Working Conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck", page 21 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 532 . – NO: ◆ GATHER more information from customer about the complaint.
2	• The Engine Control Module -J623- must remain connected for the following step. The central terminal resistor is located in the Engine Control Module -J623-. • REMOVE: Transmission Control Module -J217-. Refer to appropriate repair manual. • CHECK: Transmission Control Module -J217- harness connector terminal 15 to 10 for resistance. • Specified value: 60 to 72 Ω (at approx. 20° C). – Was Value obtained?	– YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 533 . – NO: ◆ GO TO: Step 3 ⇒ page 533 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: CAN bus circuit between the Transmission Control Module -J217- harness connector 10 and the Engine Control Module -J623- harness connector T91 / 79 for resistance. • CHECK: CAN bus circuit between the Transmission Control Module -J217- harness connector 15 and the Engine Control Module -J623- harness connector T91 / 80 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 533 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 533 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Transmission Control Module -J217- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Transmission Control Module -J217-. Refer to appropriate repair manual. ♦ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC’s. ♦ If no DTC’s return the repair is complete. ♦ Return vehicle to customer.

3.6.6 Charge Air Pressure Actuator - V465- / Charge Air Pressure Actuator Position Sensor - G581-, Checking

General Description

The Engine/Motor Control Module -J623- computes the nominal charge pressure from the requested torque. If the actual charge pressure deviates from the nominal charge pressure, the wastegate is opened further by the Charge Air Pressure Actuator -V465- (charge pressure decreases) or closed further (charge pressure increases). The rapid response of the Charge Air Pressure Actuator -V465- ensures that the wastegate opens quickly in overrun mode, thereby reducing the pumping effort of the turbocharger. The wastegate is closed in the start position. The Charge Air Pressure Actuator -V465- is activated by the PWM signal, and the Charge Air Pressure Actuator Position Sensor -G581- provides position feedback.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all Safety Precautions: ⇒ P1.1 recautions”, page 2 .

- View Clean Working Conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck", page 21 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 534 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector. • IGNITION: ON. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminals 1 to 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 534 . – NO: ◆ GO TO: Step 4 ⇒ page 535 .
3	• REMOVE: Engine/Motor Control Module -J623-. Refer to appropriate repair manual. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 2 to the Engine/Motor Control Module -J623- harness connector T105 / 88 for resistance. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 5 to the Engine/Motor Control Module -J623- harness connector T105 / 41 for resistance. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 6 to the Engine/Motor Control Module -J623- harness connector T105 / 89 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 535 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 535 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine/Motor Control Module -J623-. Refer to appropriate repair manual. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 1 to the Engine/Motor Control Module -J623- harness connector T105 / 35 for resistance. • CHECK: Charge Air Pressure Actuator -V465- / Charge Air Pressure Actuator Position Sensor -G581- harness connector terminal 3 to the Engine/Motor Control Module -J623- harness connector T105 / 33 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 535 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 535 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.7 Charge Air Pressure Sensor - G31-, Checking

General Description

The Charge Air Pressure Sensor -G31- is located in the inlet to the intake manifold. The Engine Control Module -J623- uses the sensor signal to regulate the turbo boost. There is no substitute function in the event of signal failure. Charge air pressure regulation is shut off, leading to a significant reduction in engine output.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 536 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Charge Air Pressure Sensor -G31- harness connector. • IGNITION: ON. • CHECK: Charge Air Pressure Sensor -G31- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 536 . – NO: ♦ GO TO: Step 4 ⇒ page 537 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Charge Air Pressure Sensor -G31- harness connector terminal 4 to the Engine Control Module - J623- harness connector T91 / 55 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Charge Air Pressure Sensor -G31-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 537 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 537 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Charge Air Pressure Sensor -G31- harness connector terminal 1 to the Engine Control Module - J623- harness connector T91 / 35 for resistance. • CHECK: Charge Air Pressure Sensor -G31- harness connector terminal 3 to the Engine Control Module - J623- harness connector T91 / 32 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 537 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 537 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC’s. ♦ If no DTC’s return the repair is complete. ♦ Return vehicle to customer.

3.6.8 Engine Coolant Temperature Sensor - G62-, Checking

General Description

The Engine Coolant Temperature Sensor -G62- sends information about the current coolant temperature to the Engine Control Module -J623-. It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.

- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Gear Shift Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 538 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor -G62- harness connector. • CHECK: Engine Coolant Temperature Sensor -G62- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2,250 Ω (+/- 750 @ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 538 . – NO: ♦ REPLACE: Engine Coolant Temperature Sensor -G62-. Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 539 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Engine Coolant Temperature Sensor -G62- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 47 for resistance. • CHECK: Engine Coolant Temperature Sensor -G62- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 40 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ TIP: The Engine Coolant Temperature Sensor -G62- may fail under loaded operation; please swap a known good Engine Coolant Temperature Sensor -G62- prior to continuing to the next step. ♦ GO TO: Step 4 ⇒ page 539 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 539 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC’s. ◆ If no DTC’s return the repair is complete. ◆ Return vehicle to customer.

3.6.9 Engine Coolant Temperature Sensor On Radiator Outlet - G83-, Checking

Function

The Engine Coolant Temperature Sensor On Radiator Outlet -G83- sends information about the current coolant temperature to the Engine Control Module -J623-. It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

◆ Multimeter

◆ Wiring Diagram

◆ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Gear Shift Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck", page 21 . – Was Complaint verified?	– YES: ◆ GO TO Step 2 ⇒ page 540 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor On Radiator Outlet -G83- harness connector. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet -G83- terminals 1 to 2 for resistance. • SPECIFIED VALUE: 1,500 - 3,500 Ω (+/- 500 Ω @ approx. 20° C). • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO Step 3 ⇒ page 540 . – NO: ◆ REPLACE: Engine Coolant Temperature Sensor On Radiator Outlet -G83-. Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 540 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet -G83- harness connector terminal 1 to the Engine Control Module - J623- harness connector T91 / 49 for resistance. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet -G83- harness connector terminal 2 to the Engine Control Module - J623- harness connector T91 / 29 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE Engine Control Module -J623-. Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 540 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 540 .
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ Check the DTC memory. Refer to ⇒ M3.3.3 ode 03 - Read DTC Memory", page 28 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer.

3.6.10 Engine Speed Sensor - G28-, Checking

General Description

The Engine Speed Sensor -G28- detects rpm and reference marks from a toothed wheel on the crankshaft. Without an engine speed signal, the engine will not start. If the engine speed signal fails while the engine is running, the engine will stop immediately.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 541 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • CONNECT: Scan Tool. • START or CRANK: Engine. • CHECK: Engine rpm. • SPECIFIED VALUE: Cranking or Idle rpm. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 542 . – NO: ♦ GO TO: Step 3 ⇒ page 542 .

Step	Procedure	Result / Action to Take
3	• DISCONNECT: Engine Speed Sensor -G28- harness connector. • REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Engine Speed Sensor -G28- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. • CHECK: Engine Speed Sensor -G28- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 70 for resistance. • CHECK: Engine Speed Sensor -G28- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REMOVE: Engine Speed Sensor -G28-. Refer to appropriate repair manual. ♦ CHECK: Engine Speed Sensor -G28- sensor wheel for proper seating, damage and/or run - out. Repair as required. Refer to appropriate repair manual. ♦ Sensor wheel OK. ♦ GO TO: Step 4 ⇒ page 542 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 542 .
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.6.11 EVAP Canister Purge Regulator Valve 1 - N80-, Checking

General Description

EVAP system is designed so that the admission of fuel vapors takes place only at idle and at light part-throttle. The EVAP Canister Purge Regulator Valve 1 -N80- is activated by the Engine Control Module -J623- to accomplish this task.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 543 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: EVAP Canister Purge Regulator Valve 1 -N80- harness connector. • CHECK: EVAP Canister Purge Regulator Valve 1 -N80- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 9 – 14 Ω (@ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 543 . – NO: ♦ REPLACE: EVAP Canister Purge Regulator Valve 1 -N80-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 544 .
3	• IGNITION: ON. • CHECK: EVAP Canister Purge Regulator Valve 1 -N80- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 544 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 544 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: EVAP Canister Purge Regulator Valve 1 -N80- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 3 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ TIP: The EVAP Canister Purge Regulator Valve 1 -N80- may fail under loaded operation; please swap a known good EVAP Canister Purge Regulator Valve 1 -N80- prior to continuing to the next step. ♦ GO TO: Step 5 ⇒ page 544 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 544 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.6.12 Fuel Delivery Unit -GX1- / Fuel Pump Control Module -J538-, Checking

General Description

The Engine Control Module -J623- tells the Fuel Pump Control Module -J538- the demand needed for fuel volume and pressure and activates the Transfer Fuel Pump -G6-. The Transfer Fuel Pump -G6- transfers fuel to the rest of the fuel system, where it is monitored by the Engine Control Module -J623- through sensors, and controlled through regulators and/or metering valves.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Note

When the door is opened or the Ignition is turned to the ON position the fuel pump is activated for 2 seconds to build up the pressure in the fuel system.

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 546 . ◆ NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: ON. • LISTEN: Fuel Delivery Unit -GX1- should be heard running for 2 s. • IGNITION: OFF. • SPECIFIED VALUE: Transfer Fuel Pump ON for 2 s. – Was Value obtained?	– YES: ◆ Condition may be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 547 . ◆ NO: ◆ GO TO: Step 3 ⇒ page 546 .

Step	Procedure	Result / Action to Take
3	• DISCONNECT: Fuel Pump Control Module. -J538- harness connector. • IGNITION: ON. • CHECK: Fuel Pump Control Module -J538- harness connector terminals 6 to 1 and 3 for voltage. • CHECK: Fuel Pump Control Module -J538- harness connector terminal 6 to battery voltage for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 546 . ◆ NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 547 .
4	• RECONNECT: Fuel Pump Control Module -J538- harness connector. • DISCONNECT: Fuel Delivery Unit -GX1- harness connector. • CRANK: Engine. • CHECK: Fuel Delivery Unit -GX1- harness connector terminals 1 to 5 for voltage while engine is cranking. • IGNITION: OFF. • SPECIFIED VALUE: 7 – 11 V. – Was Value obtained?	– YES: ◆ REPLACE: Fuel Delivery Unit -GX1-, Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 547 . ◆ NO: ◆ GO TO: Step 5 ⇒ page 546 .
5	• REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Fuel Pump Control Module -J538- harness connector terminal 2 to Engine Control Module -J623- harness connector terminal T91 / 9 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Fuel Pump Control Module -J538-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 547 . ◆ NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 547 .

Step	Procedure	Result / Action to Take
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.13 Fuel Injector, Checking

Includes:

Cylinder 1 Fuel Injector -N30-

Cylinder 2 Fuel Injector -N31-

Cylinder 3 Fuel Injector -N32-

Cylinder 4 Fuel Injector -N33-

General Description

The Fuel Injectors are controlled by the Engine Control Module -J623- and are mounted normally in the cylinder head. The fuel injectors spray high-pressure atomized fuel directly into the combustion chamber.

Special tools and workshop equipment required

◆ Multimeter.

◆ Wiring Diagram.

◆ Scan Tool.

◆ LED Test Lamp.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .

- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 548 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Harness connector from suspect Fuel Injector. • CHECK: Suspect Fuel Injector component connector terminals 1 to 2 for resistance (refer to the wiring diagram for proper terminal locations). • SPECIFIED VALUE: 0.5 – 15 Ω (@ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 548 . – NO: ◆ REPLACE: Suspect Fuel Injector(s). Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 549 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Suspect Fuel Injector harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 22, 23, 64, or 65. (refer to the wiring diagram for proper terminal locations). • CHECK: Suspect Fuel Injector harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 1, 2, 43, or 85. (refer to the wiring diagram for proper terminal locations). • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ TIP: The Fuel Injector may fail under loaded operation; please swap a known good Fuel Injector prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 549 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 549 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC’s. ♦ If no DTC’s return the repair is complete. ♦ Return vehicle to customer.

3.6.14 Fuel Pressure Regulator Valve - N276-, Checking

General Description

The Engine Control Module -J623- regulates Fuel Pressure Regulator Valve -N276- directly at the High Pressure Fuel Pump to control the low pressure valve inside the High Pressure Fuel Pump.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck", page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 550 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Pressure Regulator Valve -N276- harness connector. • CHECK: Fuel Pressure Regulator Valve - N276- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 1.5 to 11 Ω (+/- 0.5 Ω at approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 550 . – NO: ♦ REPLACE: Fuel Pressure Regulator Valve - N276-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 551 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • For: CHECK: Fuel Pressure Regulator Valve -N276- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 93 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 550 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 551 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • For: CHECK: Fuel Pressure Regulator Valve -N276- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 92 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ TIP: The Fuel Pressure Regulator Valve -N276- may fail under loaded operation; please swap a known good Fuel Pressure Regulator Valve -N276- prior to continuing to the next step. ♦ GO TO: Step 5 ⇒ page 551 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 551 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.6.15 Fuel Pressure Sensor - G247-, Checking

General Description

The Fuel Pressure Sensor -G247- measures the fuel pressure in the high-pressure fuel system. The Engine Control Module -J623- analyzes the signal and regulates the fuel high pressure through the Fuel Pressure Regulator Valve -N276- or Fuel Metering Valve 2 -N402- or Fuel Metering Valve -N290- (depending on vehicle) in the high-pressure pump.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck", page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 552 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Pressure Sensor -G247- harness connector. • IGNITION: ON. • CHECK: Fuel Pressure Sensor -G247- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 552 . – NO: ♦ GO TO: Step 4 ⇒ page 552 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Fuel Pressure Sensor -G247- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 49 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Fuel Pressure Sensor -G247-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 553 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 553 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Fuel Pressure Sensor -G247- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. • CHECK: Fuel Pressure Sensor -G247- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 553 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 553 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.16 Ignition Coils With Power Output Stage , Checking

Includes:

Ignition Coil 1 With Power Output Stage -N70-

Ignition Coil 2 With Power Output Stage -N127-

Ignition Coil 3 With Power Output Stage -N291-

Ignition Coil 4 With Power Output Stage -N292-

Ignition Coil 5 With Power Output Stage -N323-

Ignition Coil 6 With Power Output Stage -N324-

General Description

The ignition coil must transform the relatively low 12 V on-board vehicle voltage to the high ignition voltage required and supply the energy stored in that voltage to the spark plug. The functional principle of the ignition coil is relatively simple. It has a primary winding (small number of turns) and a secondary winding (lots of turns). The turn ratio between the number of primary and secondary winding turns determines the level of the voltage generated at the output. Ignition Coils With Power Output Stage are plugged directly into the spark plug. This means that the ignition energy can be transferred directly to the spark plug with virtually zero power loss.

Special tools and workshop equipment required

◆ Multimeter.

◆ Wiring Diagram.

◆ Scan Tool.

◆ LED Test Lamp.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 554 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Suspect Ignition Coil With Power Output Stage harness connector. • IGNITION: ON. • CHECK: Suspect Ignition Coil With Power Output Stage harness connector terminals 4 to 1 and 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 554 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 555 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Suspect Ignition Coil With Power Output Stage harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 57, 62, 76, or 79 for resistance. Refer to appropriate wiring diagram for proper terminal locations. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 555 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 555 .

Step	Procedure	Result / Action to Take
4	• DISCONNECT: All of the Fuel Injectors. Refer to appropriate wiring diagram. • DISCONNECT: Cold Start Injector (If applicable). • CONNECT: Engine Control Module - J623- harness connector. • CONNECT: LED Test Lamp to Suspect Ignition Coil With Power Output Stage harness connector terminals 2 to 3. • CRANK: Engine. • SPECIFIED VALUE: LED Test Lamp should Flicker ON & OFF. – Was Value obtained?	– YES: ♦ REPLACE: Ignition Coil With Power Output Stage. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 555 . – NO: ♦ GO TO: Step 5 ⇒ page 555 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC’s. ♦ If no DTC’s return the repair is complete. ♦ Return vehicle to customer.

3.6.17 Intake Manifold Runner Control Valve -N316-, Checking

General Description

The intake manifold runner valve(s) are mounted on a common shaft and actuated by a vacuum cell. The partial vacuum required for actuation is supplied by the Intake Manifold Runner Control Valve -N316-. The Engine Control Module -J623- activates the Intake Manifold Runner Control Valve -N316- on the basis of a characteristic map.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

• Fuses OK.

- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 556 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Intake Manifold Runner Control Valve -N316- harness connector. • CHECK: Intake Manifold Runner Control Valve -N316- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 12 – 20 Ω (@ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 556 . – NO: ♦ REPLACE: Intake Manifold Runner Control Valve -N316-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 557 .
3	• IGNITION: ON. • CHECK: Intake Manifold Runner Control Valve -N316- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 557 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 557 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Intake Manifold Runner Control Valve -N316- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 53 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ TIP: The Intake Manifold Runner Control Valve -N316- may fail under loaded operation; please swap a known good Intake Manifold Runner Control Valve -N316- prior to continuing to the next step. ♦ GO TO: Step 5 ⇒ page 557 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 557 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.6.18 Intake Manifold Runner Position Sensor -G336-, Checking

General Description

The Intake Manifold Runner Position Sensor -G336- monitors the position of the intake manifold runner flaps. These flaps can be adjusted open or closed to provide longer or shorter intake runners depending on ambient conditions to increase engine efficiency.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 558 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Intake Manifold Runner Position Sensor -G336- harness connector. • IGNITION: ON. • CHECK: Intake Manifold Runner Position Sensor -G336- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 558 . – NO: ♦ GO TO: Step 4 ⇒ page 559 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Intake Manifold Runner Position Sensor -G336- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 36 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Intake Manifold Runner Position Sensor -G336-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 559 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 559 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Intake Manifold Runner Position Sensor -G336- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 48 for resistance. • CHECK: Intake Manifold Runner Position Sensor -G336- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 47 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 559 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 559 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.6.19 Intake Manifold Sensor -GX9-, Checking

General Description

Air mass and charge pressure are two factors used for engine load management. For this purpose, there are several sensors with absolutely identical functions. They measure the intake air temperature and the intake manifold pressure. The first sender unit is located upstream of the Throttle Valve Control Module -J338- in the Intake Manifold Sensor -GX9-. They measure the pressure and temperature of the air in each individual cylinder bank. The values measured here correspond to the actual air mass in the cylinder bank(s).

The Intake Manifold Sensor -GX9- contains the following components:

♦ – Intake Air Temperature Sensor -G42-.

♦ – Manifold Absolute Pressure Sensor -G71-.

The Intake Manifold Sensor -GX9- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicle’s refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 560 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: ON. • DISCONNECT: Intake Manifold Sensor -GX9- harness connector. • CHECK: Intake Manifold Sensor -GX9- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 560 . – NO: ♦ GO TO: Step 4 ⇒ page 561 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Intake Manifold Sensor -GX9- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 51 for resistance. • CHECK: Intake Manifold Sensor -GX9- harness connector terminal 4 to the Engine Control Module - J623- harness connector T105 / 52 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω) – Were Values obtained?	– YES: ♦ REPLACE: Intake Manifold Sensor -GX9-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 561 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 561 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Intake Manifold Sensor -GX9- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. • CHECK: Intake Manifold Sensor -GX9- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 48 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 561 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 561 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC’s. ♦ If no DTC’s return the repair is complete. ♦ Return vehicle to customer.

3.6.20 Knock Sensor 1 -G61-, Checking

General Description

The Knock Sensor 1 -G61- is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The Engine Control Module -J623- uses this signal to determine the presence of engine knock and to retard spark timing.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.

- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 562 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • CONNECT: Scan tool. • START: Engine and let Idle. • CHECK: The ignition advance timing value. • TAP: Near the Knock Sensor 1 -G61- area and monitor for any fluctuations in the ignition timing advance value. • IGNITION: OFF. • SPECIFIED VALUE: 1 – 10 degrees of ignition timing fluctuation. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 563 . – NO: ♦ GO TO: Step 3 ⇒ page 562 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Knock Sensor 1 -G61- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 98 for resistance. • CHECK: Knock Sensor 1 -G61- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 97 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ TIP: The Knock Sensor 1 -G61- may fail under loaded operation; please swap a known good Knock Sensor 1 -G61- prior to continuing to the next step. ♦ GO TO: Step 4 ⇒ page 563 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 563 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.21 Leak Detection Pump - V144- / DM – TL (Tank Leak Diagnostic Module), Checking

General Description

The fuel tank has an integrated ventilation system in order to enable pressure equalization between the fuel tank and the environment when temperature variations occur or when fuel is added to or extracted from the tank. To prevent fuel evaporation to the atmosphere, a charcoal canister is installed between the fuel tank and the atmosphere. Since the charcoal canister has a limited storage capacity, it must be occasionally discharged into the intake manifold by using the evaporative emission (EVAP) canister purge valve for a short period of time. In systems without a turbocharger, an EVAP purge line from the canister purge valve to the intake manifold is sufficient. The tank leak diagnostic module (DM-TL) consists of an electrically operated air pump (DM-TL pump), an orifice with a defined diameter serving as a reference leak, and a change-over valve switching the air flow between the reference leak and the tank. If neither the pump nor the change-over valve is activated, the tank is ventilated through a bypass in the module. The canister purge valve can be actively checked using the DM-TL. For this purpose, the current consumption of the DM-TL pump is measured during a reference measurement and under different monitoring conditions. The pump current can be used to determine the pressure in the EVAP system and check the canister purge valve for proper operation.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.
- ♦ Hand Vacuum Pump.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 564 . – NO: ♦ GATHER more information from customer about the complaint.
2	• REMOVE: Evaporative Canister. Refer to appropriate repair manual. • Plug or Cap off the Leak Detection Pump - V144- hose going to the vent filter. • CONNECT: Hand vacuum pump to the Leak Detection Pump - V144- and apply 0.700 bar and see if the vacuum holds. – Did the vacuum hold?	– YES: ♦ GO TO Step 3 ⇒ page 564 . – NO: ♦ REPLACE: Leak Detection Pump - V144-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 565 .
3	• IGNITION: OFF. • DISCONNECT: Leak Detection Pump -V144- harness connector. • IGNITION: ON. • CHECK: Leak Detection Pump -V144- harness connector terminal 4 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 565 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 565 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Leak Detection Pump -V144- harness connector terminal 1 to the Engine Control Module -J623- harness connector T91 / 78 for resistance. • CHECK: Leak Detection Pump -V144- harness connector terminal 2 to the Engine Control Module -J623- harness connector T91 / 23 for resistance. • CHECK: Leak Detection Pump -V144- harness connector terminal 3 to the Engine Control Module -J623- harness connector T91 / 39 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Leak Detection Pump -V144-. Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 565 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 565 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC’s. ◆ If no DTC’s return, the repair is complete. ◆ Return vehicle to customer.

3.6.22 Motronic Engine Control Module Power Supply Relay - J271-, Checking

General Description

The following procedure is used to diagnose the Motronic Engine Control Module Power Supply Relay -J271- and the Engine Control Module -J623- power supply voltage that is provided by the Motronic Engine Control Module Power Supply Relay -J271-.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 566 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Motronic Engine Control Module Power Supply Relay -J271- Refer to appropriate repair manual. • IGNITION: ON. • CHECK: Motronic Engine Control Module Power Supply Relay -J271- socket terminals 30 and 86 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 566 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 567 .
3	• CONNECT: Jumper wire Motronic Engine Control Module Power Supply Relay -J271- socket terminals 30 and 87. • IGNITION: ON. • CHECK: Engine Control Module -J623- harness connector T91 / 5 and T91 / 6 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 567 . – NO: ♦ GO TO: Step 5 ⇒ page 567 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Jumper wire Motronic Engine Control Module Power Supply Relay -J271- socket terminals 30 and 87. • CHECK: Motronic Engine Control Module Power Supply Relay -J271- socket terminal 85 to the Engine Control Module -J623- harness connector T91 / 7 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Motronic Engine Control Module Power Supply Relay -J271-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 567 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 567 .
5	• REMOVE: Jumper wire Motronic Engine Control Module Power Supply Relay -J271- socket terminals 30 and 87. • REMOVE: Appropriate fuse. Refer to the wiring diagram for correct fuse. • CHECK: Downstream (output) side of Appropriate fuse. Refer to the wiring diagram for correct fuse to Engine Control Module -J623- harness connector T91 / 5 and T91/ 6 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Fuse panel. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 567 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 567 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.23 Outside Air Temperature Sensor - G17-, Checking

General Description

The ambient or Outside Air Temperature Sensor -G17- is a negative temperature coefficient (NTC) sensor that informs the semiautomatic / automatic temperature control system of outside air temperature. An NTC sensor resistance decreases as the temperature increases. The computer uses this input along with different in-car temperature sensors to control temperature and blower speed. When there is a problem with this sensor, performance will suffer and the compressor clutch may not engage.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 568 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Outside Air Temperature Sensor -G17- harness connector. • CHECK: Outside Air Temperature Sensor -G17- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 1,300 Ω (+/- 500 Ω @ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 569 . – NO: ♦ REPLACE: Outside Air Temperature Sensor -G17-. Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 569 .

Step	Procedure	Result / Action to Take
3	• REMOVE: Instrument Cluster Control Module -J285-. Refer to appropriate repair manual. • CHECK: Outside Air Temperature Sensor -G17- harness connector terminal 1 to the Instrument Cluster Control Module -J285- harness connector T32 / 20 for resistance. • CHECK: Outside Air Temperature Sensor -G17- harness connector terminal 2 to the Instrument Cluster Control Module -J285- harness connector T32 / 19 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 569 . – NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 569 .
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.6.24 Oxygen Sensor 1 After Catalytic Converter -GX7-, Checking

General Description

The Oxygen Sensor 1 After Catalytic Converter -GX7- downstream of the primary catalytic converter supplies the Engine Control Module -J623- with a voltage signal (nonlinear) indicating "rich" or "lean. If the primary catalytic converter is supersaturated with oxygen (lean mixture), Oxygen Sensor 1 After Catalytic Converter -GX7- will send the Engine Control Module -J623- a nonlinear signal indicating the lean mixture condition. The mixture is then enriched with fuel until the oxygen has been "displaced" from the catalytic converter. This condition, in turn, is registered by Oxygen Sensor 1 After Catalytic Converter -GX7- as a nonlinear signal indicating the rich mixture condition. The mixture is then leaned out by the Engine Control Module -J623-. If the nonlinear signal is received again, the mixture will again be enriched. The frequency, or period, during which the mixture is enriched or leaned out is variable, being dependent on the gas flow rate (engine load) at that moment.

Note the Oxygen Sensor 1 After Catalytic Converter -GX7- is also referred to as the Oxygen Sensor After Three Way Catalytic Converter -G130-.

The Oxygen Sensor 1 After Catalytic Converter -GX7- contains the following components:

- Oxygen Sensor After Three Way Catalytic Converter -G130-
- Heater For Oxygen Sensor 1 After Catalytic Converter -Z29-

The Oxygen Sensor 1 After Catalytic Converter -GX7- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to Oxygen Sensor Preliminary Tests in ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 570 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector. • CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 1 – 5 Ω (@ 25° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 571 . – NO: ♦ REPLACE: Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 572 .

Step	Procedure	Result / Action to Take
3	• IGNITION: ON. • CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 571 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 572 .
4	• RECONNECT: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in diagnostic mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ M3.3 odes 01 - 09", page 24 . • IGNITION: OFF. • SPECIFIED VALUE: Mode 6 Pass. – Were Values obtained?	– YES: ♦ FAULT: Is intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 572 . – NO: ♦ GO TO: Step 5 ⇒ page 571 .
5	• DISCONNECT: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector. • REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • FOR: 2015- 2016 JETTA, BEETLE with (1.8L), PASSAT From June 2014, CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector terminal 2 to the Engine Control Module -J623- harness connector T91 / 11 for resistance. • FOR: 2013 - 2014 JETTA, BEETLE with (2.0L), PASSAT Through June 2014, CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector terminal 2 to the Engine Control Module -J623- harness connector T91 / 91 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector terminal 3 to the Engine Control Module -J623- harness connector T91 / 26 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter -GX7- harness connector terminal 4 to the Engine Control Module -J623- harness connector T91 / 25 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Oxygen Sensor 1 After Catalytic Converter -GX7-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 572 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 572 .

Step	Procedure	Result / Action to Take
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.6.25 Oxygen Sensor 1 Before Catalytic Converter -GX10-, Checking

General Description

The Oxygen Sensor 1 Before Catalytic Converter -GX10- does not actually measure oxygen concentration, but rather the difference between the amount of oxygen in the exhaust gas and the amount of oxygen in air. Rich mixture causes an oxygen demand. This demand causes a voltage to build up, due to transportation of oxygen ions through the Oxygen Sensor 1 Before Catalytic Converter -GX10- layer. Lean mixture causes low voltage, since there is an oxygen excess. The Oxygen Sensor 1 Before Catalytic Converter -GX10- and catalytic converters are used in order to reduce exhaust emissions. Information on oxygen concentration is sent to Engine Control Module -J623-, which adjusts the amount of fuel injected into the engine to compensate for excess air or excess fuel. The Engine Control Module -J623- attempts to maintain, on average, a certain air–fuel ratio by interpreting the information it gains from the Oxygen Sensor 1 Before Catalytic Converter -GX10-. The primary goal is a compromise between power, fuel economy, and emissions. The heater for Oxygen Sensor 1 Before Catalytic Converter -GX10- is designed to minimize the time-to-readiness for closed-loop operation by heating the Oxygen Sensor 1 Before Catalytic Converter -GX10- as quickly as possible.

Note the Oxygen Sensor 1 Before Catalytic Converter -GX10- is also referred to as the Heated Oxygen Sensor -G39-.

The Oxygen Sensor 1 Before Catalytic Converter -GX10- contains the following components:

♦ Heated Oxygen Sensor -G39-

♦ Oxygen Sensor Heater -Z19-

The Oxygen Sensor 1 Before Catalytic Converter -GX10- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to Oxygen Sensor Preliminary Tests in ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 573 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- component connector terminals 3 to 4 for resistance. • SPECIFIED VALUE: 2 – 4 Ω (@ 25° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 573 . – NO: ♦ REPLACE: Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 575 .
3	• IGNITION: ON. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 4 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 574 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 575 .

Step	Procedure	Result / Action to Take
4	• RECONNECT: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in diagnostic mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ M3.3 odes 01 - 09”, page 24 . • IGNITION: OFF. • SPECIFIED VALUE: Mode 6 Pass. – Were Values obtained?	– YES: ♦ FAULT: Is intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 575 . – NO: ♦ GO TO: Step 5 ⇒ page 574 .
5	• DISCONNECT: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector. • REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 1 to the Engine Control Module -J623- harness connector T91 / 43 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 2 to the Engine Control Module -J623- harness connector T91 / 44 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 3 to the Engine Control Module -J623- harness connector T91 / 74 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter -GX10- harness connector terminal 5 to the Engine Control Module -J623- harness connector T91 / 41 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Oxygen Sensor 1 Before Catalytic Converter -GX10-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 575 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 575 .

Step	Procedure	Result / Action to Take
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.26 Radiator Shutter Motor -V544-, Checking

General Description

The Radiator Shutter Motor - V544- is used to control the mass air flow entering the lower air inlet. By closing the Radiator Shutter Motor - V544-, the head wind towards the radiator and into the engine compartment is reduced. This measure minimizes the warm-up cycle and, in addition, decreases the air resistance at the vehicle's radiator grille, thus reducing the drag coefficient (cd). At the beginning of the warm-up cycle, the Radiator Shutter Motor - V544- is closed and remains closed until the engine coolant temperature has reached a defined threshold value (80 °C). As soon as this temperature threshold has been exceeded, the Radiator Shutter Motor - V544- is opened to provide the required cooling. If the engine coolant temperature falls below the temperature threshold again during the driving cycle (e.g. due to engine stop phases during start/stop operation), the Radiator Shutter Motor - V544- is closed again. Outside of the warm-up cycle, the Engine Control Module -J623- determines the set point position of the Radiator Shutter Motor - V544- using the vehicle speed and the cooling requirement of single partial functions (e.g. engine, air conditioning, charge air).

Special tools and workshop equipment required

◆ Multimeter.

◆ Wiring Diagram.

◆ Scan Tool.

Test requirements

• Fuses OK.

• Battery voltage OK.

• Switch OFF all electrical and electronic accessories.

- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 576 . – NO: ♦ GATHER more information from customer about the complaint.
2	• DISCONNECT: Radiator Shutter Motor - V544- harness connector. • IGNITION: ON. • CHECK: Radiator Shutter Motor - V544- harness connector terminals 1 to 4 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 576 . – NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ REPLACE: Any open fuses. ♦ GO TO: Step 4 ⇒ page 577 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Radiator Shutter Motor - V544- harness connector terminal 3 to the Engine Control Module - J623- harness connector T91 / 76 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 577 . – NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 577 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.6.27 Secondary Air Injection Pump Relay - J299- / Secondary Air Injection Pump Motor - V101-, Checking

General Description

The secondary air injection system sends air into the exhaust using passages in the cylinder head. This extra air injection takes place using the Secondary Air Injection Pump Motor -V101- that is powered by the Secondary Air Injection Pump Relay -J299- on a cold-start of the engine for about 45 – 100 sec. and serves to quickly heat the catalytic converter(s) for improved emissions.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

• Fuses OK.

• Battery voltage OK.

• Switch OFF all electrical and electronic accessories.

• Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.

• Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.

• Observe all safety precautions: ⇒ P1.1 recautions", page 2 .

• View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .

• For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck", page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 578 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • REMOVE:Secondary Air Injection Pump Relay -J299- from fuse box. Refer to appropriate repair manual. • IGNITION: ON. • CHECK: Secondary Air Injection Pump Relay -J299- socket terminals 1 (86) and 3 (30) to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 578 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 7 ⇒ page 579 .
3	• IGNITION: OFF. • CONNECT: Jumper wire, Secondary Air Injection Pump Relay -J299- socket terminals 3 (30) and 5 (87). • IGNITION: ON. • SPECIFIED VALUE:Secondary Air Injection Pump Motor -V101- should be heard running. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 6 ⇒ page 579 . – NO: ♦ GO TO: Step 4 ⇒ page 578 .
4	• REMOVE: Jumper wire, Secondary Air Injection Pump Relay -J299- socket terminals 3 (30) and 5 (87). • DISCONNECT:Secondary Air Injection Pump Motor -V101- harness connector. • CHECK: Secondary Air Injection Pump Relay -J299- socket terminal 5 (87) to the Secondary Air Injection Pump Motor -V101- harness connector terminal 2 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 579 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 7 ⇒ page 579 .

Step	Procedure	Result / Action to Take
5	• CHECK: Secondary Air Injection Pump Motor -V101- harness connector terminal 1 to ground for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Secondary Air Injection Pump Motor -V101-. Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 579 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 579 .
6	• REMOVE: Jumper wire, Secondary Air Injection Pump Relay -J299- socket terminals 3 (30) and 5 (87). • REMOVE: Engine Control Module -J623-. Refer to appropriate repair manual. • CHECK: Secondary Air Injection Pump Relay -J299- socket terminal 2 (85) to the Engine Control Module -J623- harness connector T105 / 60 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Secondary Air Injection Pump Relay -J299-. Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 579 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 579 .
7	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.28 Secondary Air System - GX24-, Checking (Passat)

General Description

The secondary air injection system sends air into the exhaust on a cold-start of the engine for about 45 – 100 sec. and serves to quickly heat the catalytic convertor(s) for improved emissions. A "pressure based secondary air diagnostics" function is used. In this system, the signal from Secondary Air Injection Sensor 1 -G609- is evaluated in the Engine Control Module -J623-. The injected air quantity is determined from the pressure level.

The Secondary Air System -GX24- contains the following components:

- ♦ Secondary Air Injection Solenoid Valve -N112-
- ♦ Secondary Air Injection Sensor 1 -G609-

The Secondary Air System -GX24- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	♦ YES: ♦ GO TO Step 2 ⇒ page 581 . ♦ NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• IGNITION: ON. • CHECK: Secondary Air System -GX24- harness connector terminal 1 to ground. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained?	♦ YES: ♦ GO TO: Step 3 ⇒ page 581 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ REPLACE: Any open Fuses. ♦ GO TO: Step 4 ⇒ page 581 .
3	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Secondary Air System -GX24- harness connector terminal 5 to the Engine Control Module - J623- harness connector T105 / 21 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	♦ YES: ♦ REPLACE: Secondary Air System -GX24-. Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 581 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 581 .
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return the repair is complete. ♦ Return vehicle to customer.

3.6.29 Secondary Air System -GX24-, Checking (All others)

General Description

The secondary air injection system sends air into the exhaust on a cold-start of the engine for about 45 – 100 sec. and serves to quickly heat the catalytic convertor(s) for improved emissions. A "pressure based secondary air diagnostics" function is used. In this system, the signal from Secondary Air

Injection Sensor 1 -G609- is evaluated in the Engine Control Module -J623-. The injected air quantity is determined from the pressure level.

The Secondary Air System -GX24- contains the following components:

- ♦ Secondary Air Injection Solenoid Valve -N112-
- ♦ Secondary Air Injection Sensor 1 -G609-

The Secondary Air System -GX24- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 582 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Secondary Air System -GX24- harness connector. • CHECK: Secondary Air System -GX24- component connector pins 1 to 5 for resistance. • SPECIFIED VALUE: 20 to 35 Ω (at approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 583 . – NO: ♦ REPLACE: Secondary Air System -GX24-. Refer to appropriate repair manual. ♦ GO TO: Step 8 ⇒ page 584 .

Step	Procedure	Result / Action to Take
3	• IGNITION: ON. • CHECK: Secondary Air System -GX24- harness connector terminal 1 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 583 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 8 ⇒ page 584 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Secondary Air System -GX24- harness connector terminal 5 to the Engine Control Module - J623- harness connector T105 / 21 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 583 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 8 ⇒ page 584 .
5	• IGNITION: ON. • CHECK: Secondary Air System -GX24- harness connector terminals 2 to 4 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 7 ⇒ page 583 . – NO: ♦ GO TO: Step 6 ⇒ page 583 .
6	• CHECK: Secondary Air System -GX24- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. • CHECK: Secondary Air System -GX24- harness connector terminal 4 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 8 ⇒ page 584 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 8 ⇒ page 584 .
7	• CHECK: Secondary Air System -GX24- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 9 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Secondary Air System -GX24-. Refer to appropriate repair manual. ♦ GO TO: Step 8 ⇒ page 584 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 8 ⇒ page 584 .

Step	Procedure	Result / Action to Take
8	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.30 Three Way Catalytic Converter (TWC), Checking

General Description

A catalytic converter is a vehicle emissions control device that converts toxic pollutants in exhaust gas to less toxic pollutants by catalyzing a redox reaction (oxidation or reduction). Catalytic converters are used in internal combustion engines.

General recommendations

Oxygen sensors OK.

No leaks or damage to exhaust system.

Prior to repair work, perform a preliminary check to verify the condition. Refer to ⇒ C3.1 heck", page 21 .

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions", page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions", page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings", page 5 .

Function test

Step	Procedure	Result / Action to Take
1	Activate Monitors: • Perform the function test in Diagnostic Mode 06. Refer to ⇒ M3.3 odes 01 - 09", page 24 . • End diagnosis and switch the ignition off. • If the specified values are exceeded:	♦ Check the exhaust system for leaks. ♦ If necessary, repair the leak(s) in the exhaust system. ♦ GO TO: Step 2 ⇒ page 585 .
2	O2 Sensor Monitoring: • Erase the DTC memory. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . • Perform a road test to verify repair. • If the DTC does not return:	♦ Generate readiness code. Refer to ⇒ C3.2 ode", page 22 . ♦ If no leaks are found in the exhaust system: ♦ Replace the catalytic converter with front exhaust pipe. Refer to appropriate repair manual. ♦ GO TO: Step 3 ⇒ page 585 .
3	• Final procedure: • Perform a road test to verify repair.	• After the repair work, the following work steps must be performed in the following sequence: • Check the DTC memory. Refer to ⇒ M3.3.3 ode 03 - Read DTC Memory", page 28 . • If necessary, erase the DTC memory. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . • If the DTC memory was erased, generate readiness code. Refer to ⇒ C3.2 ode", page 22 . • Return vehicle to Customer.

3.6.31 Throttle Valve Control Module - GX3-, Checking

General Description

Throttle valve operation occurs by an electric motor identified as EPC Throttle Drive -G186- located within the Throttle Valve Control Module -GX3-. It is controlled by the Engine Control Module - J623- with primary inputs from the Accelerator Pedal Module -GX2- as well as other peripheral inputs from EPC Throttle Drive Angle Sensor 1 -G187- and EPC Throttle Drive Angle Sensor 2 -G188-.

The Throttle Valve Control Module -GX3 / J338- contains the following components:

♦ EPC Throttle Drive -G186-

♦ EPC Throttle Drive Angle Sensor 1 -G187-

♦ EPC Throttle Drive Angle Sensor 2 -G188-

The Throttle Valve Control Module -GX3 / J338- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint Verified?	– YES: ♦ GO TO: Step 2 ⇒ page 586 . – NO: ♦ GATHER more information from customer about the complaint.
2	• CONNECT: Scan Tool. • IGNITION: ON. • CHECK: Throttle valve position closed: • SPECIFIED VALUE: 3 – 25%. • DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly. • CHECK: Throttle valve position at WOT: • SPECIFIED VALUE: 84 – 97%. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 587 . – NO: ♦ GO TO: Step 3 ⇒ page 586 .
3	• REMOVE: Throttle Valve Control Module - GX3- far enough so that the harness connector terminals are accessible. • DISCONNECT: Throttle Valve Control Module - GX3- harness connector. • IGNITION: ON. • CHECK: Throttle Valve Control Module - GX3- harness connector terminals 2 to 6 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 587 . – NO: ♦ GO TO: Step 4 ⇒ page 587 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 54 for resistance. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 6 to the Engine Control Module - J623- harness connector T105 / 56 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 6 ⇒ page 587 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 587 .
5	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 34 for resistance. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 91 for resistance. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 4 to the Engine Control Module - J623- harness connector T105 / 55 for resistance. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 5 to the Engine Control Module - J623- harness connector T105 / 90 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Throttle Valve Control Module - GX3-. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 587 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 587 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ♦ Clear the DTC’s. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory”, page 29 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode”, page 22 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC’s. ♦ If no DTC’s return the repair is complete. ♦ Return vehicle to customer.

3.6.32 Turbocharger Recirculation Valve -N249-, Checking

General Description

A Turbocharger Recirculation Valve -N249- keeps a portion of air running through the intake side of the turbocharger when the throttle valve is closed and boost pressure is still present. This keeps the turbocharger impeller from slowing down, reducing turbo lag when the throttle is applied again.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 588 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Turbocharger Recirculation Valve -N249- harness connector. • CHECK: Turbocharger Recirculation Valve -N249- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2 to 15 Ω (at approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 589 . – NO: ♦ REPLACE: Turbocharger Recirculation Valve -N249-. Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 589 .

Step	Procedure	Result / Action to Take
3	• IGNITION: ON. • CHECK: Turbocharger Recirculation Valve -N249- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 589 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 .
4	• REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Turbocharger Recirculation Valve -N249- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 66 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ TIP: The Turbocharger Recirculation Valve -N249- may fail under loaded operation; please swap a known good Turbocharger Recirculation Valve -N249- prior to continuing to the next step. ◆ GO TO: Step 5 ⇒ page 589 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 589 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module -J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module -J623-. Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ M3.3.4 ode 04 - Erase DTC Memory", page 29 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.33 Vehicle Speed Signal, Checking

General Description

The Vehicle Speed Signal or VSS measures Transmission / Transaxle output or Wheel Speed from the ABS System. The signal is broadcasted over the CAN Bus. The Engine Control

Module -J623- uses this information to modify engine functions such as ignition timing, A/F ratio, transmission shift points, and to initiate diagnostic routines.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ P1.1 recautions”, page 2 .
- View clean working conditions: ⇒ W1.2 orking Conditions”, page 4 .
- For Hybrid vehicles refer to: ⇒ V1.3 oltage System General Warnings”, page 5 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ C3.1 heck”, page 21 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 590 . – NO: ♦ GATHER more information from customer about the complaint.
2	• CONNECT: Scan Tool. • ROAD TEST: Vehicle. • CHECK: Scan Tool to Speedometer for accuracy. • SPECIFIED VALUE: Difference ≤ 10%. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 591 . – NO: ♦ GO TO: Step 3 ⇒ page 590 .
3	• CHECK: ABS system. • CHECK: ABS DTC’s. – Was the ABS system OK?	– YES: ♦ CHECK: CAN Bus wiring from Instrument Cluster Control Module -J285- to ABS Control Module -J104-. ♦ GO TO: Step 4 ⇒ page 591 . – NO: ♦ REPAIR: Any ABS concerns 1st. ♦ GO TO: Step 4 ⇒ page 591 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ Check the DTC memory. Refer to ⇒ M3.3.3 ode 03 - Read DTC Memory", page 28 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ C3.2 ode", page 22 . ◆ Return vehicle to Customer.

DAB 7-15-21 FB

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.

- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.

- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the Volkswagen Factory Approved Scan Tool (ST).

- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.

- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.

- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it

- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.

- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.

- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.

- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

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- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.

- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.

- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.

- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).

- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

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- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.

- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the Volkswagen Factory Approved Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.

- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.

- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.

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